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RESEARCH ARTICLE
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COMPARISON OF ANALGESIC EFFICACY AND DURATION OF ERECTOR SPINAE BLOCK WITH GENERAL ANAESTHESIA AND MULTIMODAL ANALGESIA WITH GENERAL ANAESTHESIA IN SPINE SURGERIES- A PROSPECTIVE, RANDOMIZED STUDY

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Abstract

Background: Perioperative pain management is an essential component of the anaesthetic procedures in patients undergoing spinal surgery that ensures patient comfort, fewer complications and early mobilization. The present study aimed to compare the efficacy of erector spinae block (ESB) with multimodal analgesia (MMA) using Paracetamol, Magnesium sulphate and Dexamethasone.

Materials and Methods: The prospective study was done on 100 patients, randomly allocated into two groups (N=50). Group I received Erector spinae block using 0.25% Bupivacaine 20 ml each side and Group II received multimodal analgesia which includes injection Paracetamol 20 mg/kg/BW, Magnesium sulphate 30 mg/kg/BW and Dexamethasone 0.1 mg/kg/BW. The following parameters were recorded: mean arterial pressure, heart rate, SpO_2, serum cortisol, random blood sugar, VAS score and first rescue analgesia, Independent t test was used for the comparison between the groups.

Results: The hemodynamic stability in terms of mean arterial pressure was significantly better in ESB group ($p<0.001$). The mean VAS scores and postoperative serum cortisol level were significantly lower in ESB group ($p<0.001$). And the time required for first rescue analgesia was significantly longer in ESB group ($p<0.001$).

Conclusion: The analgesic efficacy is better in ESB than MMA in spine surgeries.

Keywords: analgesic efficacy, erector spinae block, multimodal analgesia, spine surgery

INTRODUCTION:

In today's world, the rate of surgical procedures is increasing tremendously, particularly for spinal surgeries due to the increase in complaints of low back pain in today's lifestyle. Traditionally, acute perioperative pain management targets the central mechanisms involved in the perception of pain by opioid medications. Multimodal analgesia (MMA) is achieved by using several agents instead of a single agent, each acting at different sites of the pain pathway. This approach reduces or eliminates the need for opioids.[1,2] The synergism between opioid and non-opioid medications reduces the required opioid dose and the side effects related to them.[3,4] Moreover, regional anaesthesia has better advantages over MMA or opioid-based anaesthesia as it provides prolonged pain relief, less or no nausea and vomiting, getting early bowel functioning and better dealing with stress response and we have controlled haemodynamics and if the postoperative pain of the lumbar spine could not be effectively relieved, it may develop into chronic pain, affecting the patient's quality of life.[5,6]

Regional anaesthesia is also more acceptable by anaesthetists as it has more prolonged mode of action and by surgeons and patients as it relieves postoperative pain reduces the need for MMA or opioids and satisfies all three. Paracetamol is an acetaminophen product that is soluble in water and can be injected intravenously when there is a need for a strong effect and rapid onset of analgesic action. The mechanism of action of paracetamol is to suppress the synthesis of prostaglandins[7]. Cyclooxygenase (COX) is the first enzyme in the production cycle of prostaglandins, and paracetamol blocks this cycle and acts as an analgesic. Magnesium sulphate ($MgSO_4$) is an N-methyl-diaspartate receptor antagonist for ion channels, preventing central and peripheral sensitization resulting from environmental stimuli. It is known as a natural blocker of calcium channels with analgesic effects. Substances that block calcium channels and are N-methyl-diaspartate receptor antagonists can be effective in preventing the emergence of pain and in its control.[7] Dexamethasone (DEX) is a glucocorticoid with analgesic, sedative, and anti-inflammatory effects. DEX has been used effectively in infant surgeries to prolong the time of analgesia and decrease postoperative nausea and vomiting.[7-9] Erector spinae block (ESB) a new trunk fascia block technique was proposed in 2016.ESB can block the posterior root of the spinal nerve and produce part of the paraspinal block effect with the diffusion of the drug solution.[10-13] A report showed that ESB relieved postoperative pain in patients with lumbosacral spine surgery, reducing the use of analgesic drugs.[14] In our study, we intended to compare the efficacy of Erector spinae block (ESB) with Multimodal analgesia (MMA) in spine surgeries.

MATERIALS AND METHODS:

Sampling

After obtaining institutional ethical committee approval (MGMC&H/IEC/JPR/2022/690), this prospective double-blinded single-arm randomized controlled trial was registered in the Clinical Trial Registry of India (CTRI/2022/04/042221). The study was carried out in adherence to the principles of the Helsinki Declaration of 1975, as revised in 2013, in a tertiary care centre from May 2022 to October 2022. The sample size calculation was done using G*Power 3.1.9.2 software where with an alpha error of 0.05, beta error 0.05 and power of 0.95, the sample size was calculated as 45 for each group with a total sample size of 90. We had taken 100 samples diving it as 50 in each group. One

hundred patients of either sex from the age group of 18-65 years belonging to ASA grade I/II scheduled for elective spine surgeries (lumber spine, single level, disc dissection surgeries) under general anaesthesia were included in this study. Unwilling patients, patients with ASA classes III, IV & V, difficult surgical anatomy, local infection at the site of injection, history of allergy to opioid or local anaesthesia and inability to comprehend or participate in the pain scoring system were excluded from the study. After taking informed consent, patients were randomly assigned into 2 groups: ESB group (Group I, n=50) or MMA group (Group II, n=50) by lottery method. Group I received Erector spinae block using 0.25% Bupivacaine 20 ml each side and Group II received multimodal analgesia which includes injection of Paracetamol 20 mg/kg/BW, Magnesium sulphate 30 mg/kg/BW and Dexamethasone 0.1 mg/kg/BW.

Procedure

On the day of surgery before induction of general anaesthesia, Routine monitoring was applied including electrocardiogram (ECG), non-invasive blood pressure monitoring, oxygen saturation (SPO_2), respiratory rate, and end-tidal carbon dioxide ($ETCO_2$) measured via an $ETCO_2$ nasal cannula. The baseline heart rate, mean arterial blood pressure, SpO_2, random blood glucose and serum cortisol were recorded. All patients were pre-medicated with glycopyrrolate 0.004 mg/kg and midazolam 0.02 mg/kg. Induction of anaesthesia was achieved with a standard induction protocol for all patients with intravenous (IV) propofol (2 mg/kg), fentanyl (2 mcg/kg), and vecuronium (15 mg/kg). After endotracheal intubation, anaesthesia was maintained with isoflurane in 40% O_2: 60% nitrous oxide and intermittent muscle relaxant was given. Preoperative random blood sugar was recorded. Intraoperatively, in all groups, the hemodynamic responses were checked just before and after incision, 10 mins after incision, 60 mins after incision and then every 30 min till the end of surgery. If the mean arterial blood pressure has fallen below 50mmHg, injection of Ephedrine 6 mg was administered and an intravenous bolus of 0.6 mg atropine was administered. And in case of hypertension, 2 ml bolus propofol was administered after administering additional dose of 0.5 mg/kg fentanyl.

The blood pressure returned to the baseline value before surgical field closure. Then at the end of the surgery, the isoflurane vaporizer was shut off at the time of skin closure and the muscle relaxant was reversed with neostigmine 0.04 mg/kg and atropine 0.02 mg/ kg. The tube was removed after the patient regained consciousness, breathed spontaneously, and responded to verbal commands. Stress response was measured with preoperative, intraoperative and postoperative serum cortisol and random blood glucose levels.

The severity of pain and rescue analgesia requirement was assessed postoperatively at 1^{st}, 3^{rd}, 6^{th}, 12^{th}, 18^{th} and 24^{th} hours. The severity of pain was assessed using a visual analogue scale (VAS) score (0 - no pain and 10 - worst imaginable pain). Rescue analgesia was given with 2 mg/kg IV tramadol when the VAS scores were above 3. A rescue antiemetic was given with ondansetron (4 mg) IV when patients complained of nausea or vomiting.

Statistical analysis

The data were tabulated in Microsoft Excel and analysed with SPSS V.24 software. The normality of the distribution of different parameters was tested by the Shapiro-Wilk test. The variables were presented with mean and standard deviation. Independent t test was used for the comparisons. The p value ≤ 0.05 is considered statistically significant.

RESULTS:

From the demographic perspective, there was no significant difference between the two groups in terms of age, gender and ASA class distribution. The heart rates did not significantly differ between the groups and it was not found to be unstable throughout the procedure ($p>0.05$) (Figure 1). But

hemodynamic stability in terms of mean arterial pressure was significantly better in ESB group ($p<0.001$) (Table 1). The mean VAS scores were significantly lower in ESB group ($p<0.001$) (Table 2). The preoperative random blood sugar was slightly higher in ESB group; the intraoperative random blood sugar was slightly higher in MMA group and postoperative random blood sugar was slightly higher in ESB group (Figure 2). The preoperative serum cortisol was slightly higher in ESB group; the intraoperative and postoperative serum cortisol levels were significantly higher in MMA group ($p<0.001$) (Figure 3). The time required for first rescue analgesia was significantly longer in ESB group ($p<0.001$) (Figure 4).

DISCUSSION:

Since there is an increase in the number of patients with lumbar diseases, a large number of them need lumbar surgery. As there is obvious pain after lumbar surgery, postoperative analgesia is often needed. Multimodal analgesia may serve to optimize efficacy by using different analgesic drug classes, each of which uses different receptors and pathways for clinical effect(s) and improved surgical outcomes.[15,16] Paraneuraxial nerve blocks such as Erector spinae block (ESB) may have an advantage in success rate and analgesic efficacy[17]. In recent years, many researchers have used ESB for postoperative analgesia and found that local anaesthetic spread well, was volume-dependent, and extended into the neural foramina and epidural space normally.

The present study was conducted to evaluate and compare the analgesic efficacy of ESB and MMA methods in patients undergoing spine surgeries. We found ESB is capable of producing better hemodynamic stability than MMA. Zhang et al[18] conducted a trial by comparing the ESB group and general anaesthesia based solely on hemodynamic changes and opioid consumption, and they discovered statistically significantly lower mean values of both the heart rate and mean arterial blood pressure in patients who received ESB group versus those who only received general anaesthesia.
In our study, patients in both ESB and MMA groups had no significant preoperative levels of serum cortisol but intraoperative and postoperatively serum cortisol levels were significantly higher in the MMA group than the ESB group. We correlated this study with Yoder et al[19] who investigated serial cortisol levels at skin closure and every 2 hours up to 6 hours postoperatively as a stress response measuring tool to compare different invasive surgical procedures. The mean VAS scores were significantly lower in ESB group and this can be correlated with the time to first rescue analgesia which was significantly longer in the ESB group than in the MMA group. These findings are in accordance with Ahiskalioglo et al[20], who reported first analgesic requirements to range from 6-14 h and the median was 8 h after performing ESB for hip surgeries and this is supported by other studies also which concluded that ESB group had a longer time for rescue analgesia than MMA group.[21,22]

CONCLUSION:

From the findings of our study, we can conclude that analgesic efficacy is better in ESB than MMA in spine surgeries. Although both methods are considered as safe and both reduce the requirement for inhalational anaesthetic agents and intraoperative opioids, ESB was found to additionally provide analgesia in the postoperative period for up to 24 hours. Further studies on ESB and MMA in larger samples and in various other surgical procedures are recommended.

CONFLICT OF INTERESTS: None declared

FIGURES:

Figure 1: Heart rate at different intervals

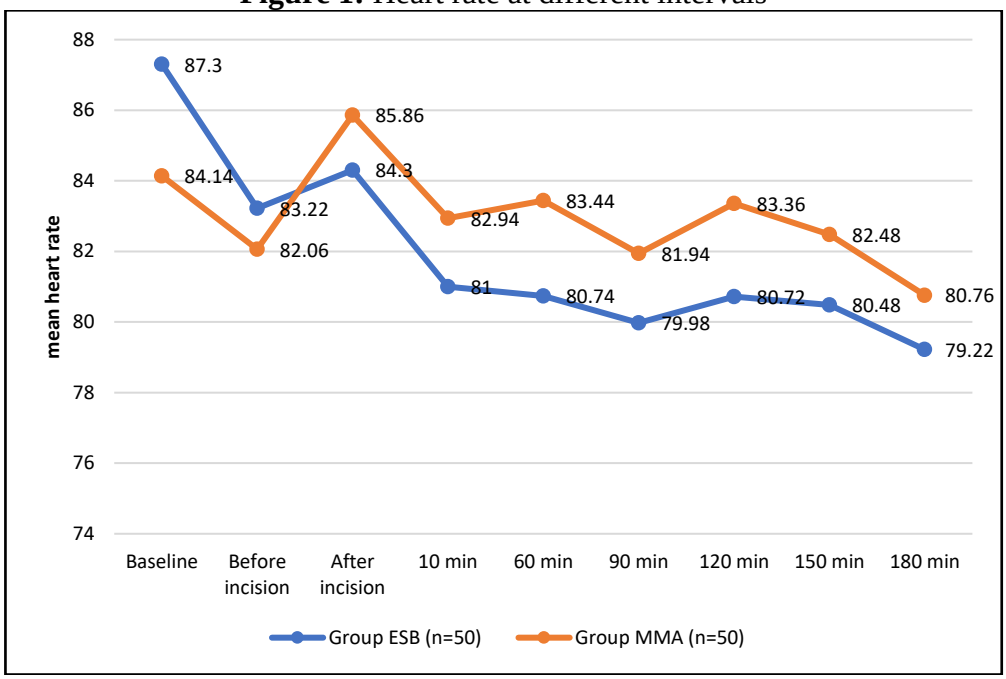


Figure 2: Requirement of 1st Rescue analgesia required in both groups

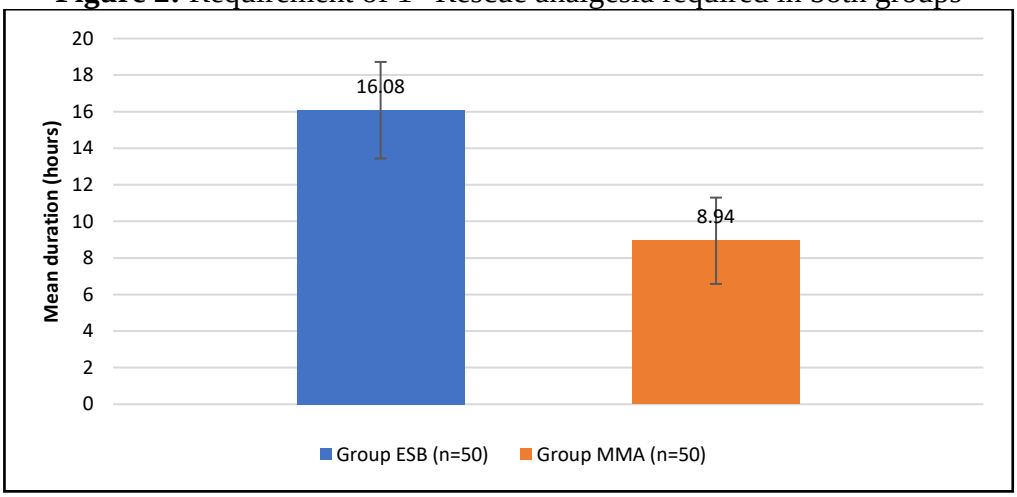


Figure 3: RBS in both groups at a different intervals

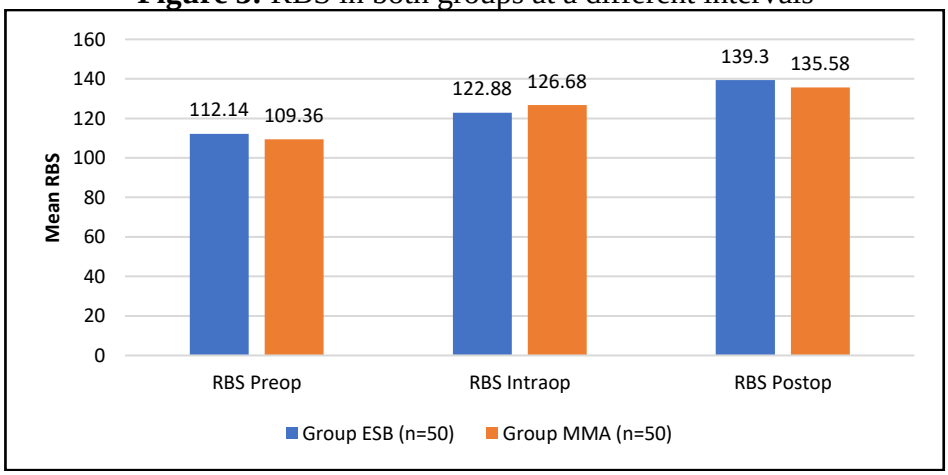
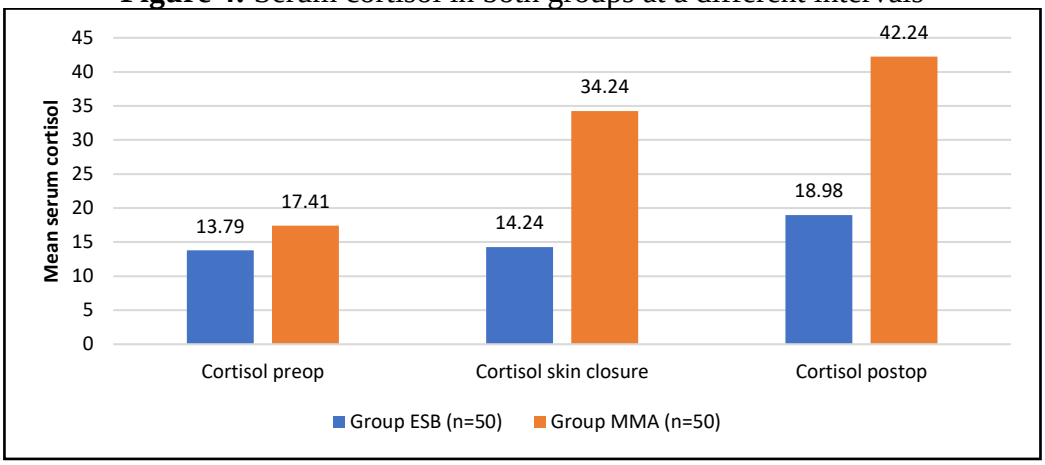


Figure 4: Serum cortisol in both groups at a different intervals



TABLES:

Table 1: Mean arterial pressure (mm Hg) in both groups at different intervals

MAP	Group I(ESB) (n=50)	Group II(MMA) (n=50)	p-value
Baseline	102.06±7.78	102.54±10.39	0.79
Before incision	96.98±5.72	97.20±9.01	0.88
After incision	94.50±6.11	102.42±10.28	<0.001
10 min	90.96±5.96	95.78±10.08	<0.01
60 min	88.70±6.30	94.64±11.88	<0.01
90 min	88.86±5.97	93.42±10.95	0.01
120 min	89.06±6.11	92.78±12.16	0.05
150 min	89.58±7.21	88.98±12.15	0.76
180 min	90.2±6.32	88.12±9.78	0.21

MAP- Mean arterial pressure, ESB- Erector Spinae Block, MMA-Multimodal Analgesia

Table 2: Visual Analogue Scale (VAS) score in both groups at different intervals

VAS score	Group I (ESB) (n=50)	Group II (MMA) (n=50)	p-value
Post extubation	0.42±0.78	2.26±1.23	<0.001
1st hour	1.26±0.80	2.94±1.19	<0.001
3rd hour	1.16±0.96	3.94±1.65	<0.001
6th hour	0.96±0.92	3.42±1.39	<0.001
12th hour	0.76±0.80	2.82±1.14	<0.001
18th hour	1.02±1.00	2.12±0.90	<0.001
24th hour	1.58±1.01	1.88±0.48	0.06

VAS-Visual analogue scale, ESB- Erector Spinae Block, MMA-Multimodal Analgesia

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