Original Article

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Comparison of Dexamethasone and Dexmedetomidine as an Adjuvant to 0.375% Ropivacaine in Erector Spinae Plane Block for Lumbar Spine Surgery: A Randomized, Double-Blind, Placebo-Control Trial.

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Abstract

Background: Erector spinae plane block (ESPB) is an interfascial plane block that successfully deposits a local anesthetic deep into the erector spinae muscle that lies adjacent to transverse processes. The present study was conducted to assess the effect of dexmedetomidine and dexamethasone as an adjuvant for the erector spinae plane block (ESPB) to control postoperative pain after lumbar spine surgery. **Subjects & Methods:** 60 patients selected for undergoing lumbar spine surgery were divided into 3 groups of 20 each. Group, I patients received 0.375% ropivacaine 20 mL group II patients received 0.375% ropivacaine 20 mL with 8 mg dexamethasone and group III patients received 0.375% ropivacaine 20 mL with 1 μg/kg dexmedetomidine deep to the erector spinae muscle. Postoperative tramadol consumption, amount of rescue analgesia use, post-surgical hospital stay and postoperative nausea and vomiting (PONV) were recorded. **Results:** The demographic data and intraoperative opioid requirements were comparable in all groups. Postoperative tramadol consumption and rescue analgesic requirement were significantly less in group III as compared to group II and I. Postoperative stay in hospital was 6.1 days in 6.2 days in group II and 4.6 days in group III and the difference was significant. **Conclusion:** Dexmedetomidine is found to be better than dexamethasone as an adjuvant to ropivacaine in erector spinae plane block in lumbar spine surgery.

Keywords: Dexmedetomidine, Dexamethasone, Erector spinae plane block, lumbar spine surgery.

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Introduction

The erector spinae plane block (ESPB) is an interfascial plane block that effectively deposits a LA deep into the erector spinae muscle that lies contiguous to transverse processes.[1] Developing research established that ESPB can be employed as a safe and simple substitute technique to address post-traumatic, acute post-surgical, and chronic neuropathic thoracic pain in adults and children. Providentially, its effectiveness to improve incisional pain has already been established in clinical studies.[2]

Dexmedetomidine is a potent $\alpha 2$ agonist and is now developing as an adjuvant to regional anesthesia and analgesia. It can lengthen the duration of the nerve block anesthesia when applied with a local anesthetic and only has minimum side effects. Dexamethasone is measured to work by decreasing the release of inflammatory mediators and by deterring potassium channel-mediated discharge of C-fibers. Results of human studies demonstrated that the dexamethasone-treated group showed a longer duration of sensory and motor blockade than the control.[3]

The mechanism by which dexamethasone and dexmedetomidine increase the duration of local anesthetics is not entirely understood and may arise from several factors. Both dexamethasone and dexmedetomidine can decrease local inflammation and extend the duration of nerve block through vasoconstriction by keeping the local concentration of the local anesthetic.[4] Vasoconstriction also hinders the nociceptive impulse transmission along myelinated C fibers. Possible mechanisms of dexmedetomidine in prolonging the duration of nerve blocks may also include the inhibition of the hyperpolarization-activated cation current. Few research studies suggested that dexmedetomidine may provide local anesthetic action that blocks the conduction of nerve signals through C and A-fibers, not through α_2 action, and may stimulate the release of enkephalin-like substances at peripheral

sites.[5] The present study was conducted to assess the effect of dexmedetomidine and dexamethasone as an adjuvant to ropivacaine in the erector spinae plane block (ESPB) to control postoperative pain after lumbar spine surgery.

Subjects and Methods

This study was planned to be a randomized, double-blinded, prospective study. The present study was conducted among 60 ASA Grade 1 and 2 patients of either sex, undergoing lumbar spine surgery. Written informed consent was taken from all patients who were enrolled in the study. Group assignments were determined using simple randomization using the sealed envelope technique. Blocks were performed by the authors who did not perform any role in data collection or analysis.

Inclusion criteria

Adult patients 18-70 years of age, ASA grade 1 and 2, of either sex, undergoing lumbar spine surgery under general anesthesia, patients who understand and comply with the study protocol.

Exclusion criteria

CKD, heart disease, pulmonary disease, opioid addiction, history of hypersensitivity to ropivacaine, revision surgery or surgery for neoplastic disease, inability to provide informed consent due to cognitive dysfunction.

Patients were divided into 3 groups of 20 each. Group, I patients received 0.375% ropivacaine 20 mL, Group II patients received 0.375% ropivacaine 20 mL with 8 mg dexamethasone and group III patients received 0.375% ropivacaine 20 mL with 1 μg/kg dexmedetomidine deep to the erector spinae muscle adjacent to transverse processes.

Postoperative tramadol consumption, amount of rescue analgesia use, post-surgical hospital stay and postoperative nausea and vomiting (PONV)were recorded. Results thus obtained were subjected to statistical analysis. A P-value of less than 0.05 was considered significant.

General anesthesia management

All patients received the same anesthesia and analgesia protocol. All patients were premedicated with tablet lorazepam 0.04 mg/ kg and ranitidine 150 mg at night and 2 h before surgery. On arrival to the operation room, i. v. assess was achieved with 18 gauge venous cannula. Monitoring consisted of 5 lead electrocardiography, pulse oximeter, noninvasive blood pressure, temperature, and end-tidal CO2 monitoring. Following preoxygenation with 100% oxygen, patients were induced with fentanyl 2 μg/kg and propofol (1-2 mg/kg). Intubation was facilitated by vecuronium bromide 0.1 mg/kg and thereafter mechanical ventilation was initiated. Anaesthesia was maintained using 70% nitrous oxide in oxygen and isoflurane 0.5-1% and intermittent boluses of fentanyl and vecuronium as and when required. Ondansetron 8 mg i.v. was given to all patients approximately 30 min before the end of surgery. At the end of the surgery, a reversal of anesthesia was done with injection neostigmine 0.05 mg/ kg + glycopyrrolate 0.01 mg/kg and patients were transferred to the postanesthesia care unit (PACU).

Landmark guided erector spinae block

All blocks were performed under general anesthesia in the prone position under aseptic conditions before starting the surgical procedure. The L1 lumbar vertebral level was assessed by counting downwards from the cervical level. A mark 3 cm lateral to the spinous process bilaterally was marked. A 22 gauge 10 cm spinal needle was used to contact the transverse process, aspiration test was done to circumvent unintentional vascular injection. Study drugs were given and the needle was removed.

Standard analgesia protocol

The perioperative intravenous analgesia protocol comprises paracetamol 1 gm and fentanyl 0.5 ug/kg bolus as and when needed. All patients were followed using a standardized post-operative analgesia protocol which includes IV paracetamol every 6 hrly. Intermittent 1 mg/kg of iv tramadol given to the patient. The dosage is repeated every 4 hrly if NRS >4/10 and recorded. For rescue analgesia during 1–24 h, slow intravenous diclofenac sodium aqueous 75 mg was administered if NRS $\geq$4 even after iv tramadol.

Result

[Table 1] lists patient data. There was no significant difference in intraoperative characteristics among groups, which includes age, height, weight, BMI, duration of surgery. The duration of surgery was 180.4 minutes, in group II was 152.4 minutes and in group III was 162.8 minutes, consumption of intraoperative fentanyl was 125μg, in group I, 115.3 μg in group II was 100.5 μg in group III. The difference was non-significant (P> 0.05).

[Table 2 & Figure 1] shows that postoperative tramadol consumption was 300 $\pm$ 55 mg in group I, 250 $\pm$ 40 mg in group II and 100 $\pm$ 20 mg in group III, Rescue analgesic use was 75, 50 and 10 mg in group I, II and III respectively, Postoperative stay in hospital was 6.1 days in group I, 6.2 days in group II and 4.6 days in group III. and these differences were significant, P<0.05. PONV was 5.2, 5.5 and 4 in groups I, II and III respectively and was not significant.

Discussion

Interfascial plane blocks have transfigured the management of acute perioperative and chronic pain. After the first report of ultrasound-guided erector spinae plane block (ESPB) by Forero et al, it has been reported to deliver analgesia for

Table 1: Demographic data of patients and intraoperative parameters

	Group 1	Group II	Group III	P
Age (years)	40.61±11.06	43.00± 10.35	45.00±01	0.586
Height(cm)	156.35±6.04	155.16±4.61	154.11±5.5	0.798
Weight(kg)	54.81±9.55	53.39±8.32	50.22±7.2	0.924
BMI ($kg.m^{-2}$)	1.54±0.14	1.51±0.11	1.55±0.12	0.839
Duration of surgery (min)	180.4	152.4	162.8	0.372
Consumption of fentanyl (ug)	125	115.3	100.5	0.562

Table 2: Comparison of Parameters

Parameters	Group I	Group II	Group III	P-value
Postoperative tramadol consumption(mg)	300 ± 55	250 ± 40	100 ± 20	0.02
Postoperative stay in hospital (day)	6.1	6.2	4.6	0.01
Rescue analgesia (Diclofenac)mg	75	50	10	0.001
PONV	5.2	5.5	4	0.81

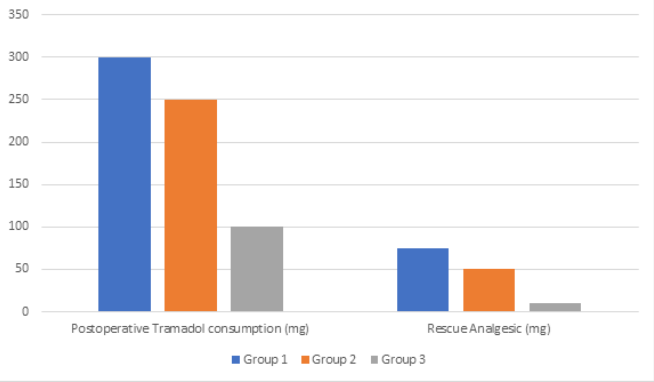

Figure 1: Comparison of Parameters

several indications. Nevertheless, not all hospitals are fortified with ultrasound machines in the operation theatre and trained anesthesiologists.[6]

Landmark-guided ESPB can be executed with the patient in a lateral, prone, or sitting position. The purpose is to deposit local anaesthetic into the fascial plane deep to erector spinae muscle which blocks the dorsal and ventral rami of the spinal nerve subject to the level of injection and the amount of local anesthetic injected. The spinous process of the vertebra and a point 3 cm lateral to it is discernible at a suitable level before performing the block. Under aseptic precautions, the needle is introduced and advanced perpendicular to the skin in all planes to contact the transverse process of the vertebra. The transverse process of the lumbar vertebra lies at a variable depth of 2–4 cm from the skin depending on the build of the individual. At this point, the needle tip lies between the erector spinae muscle and the transverse process. After negative aspiration, LA has injected in 3–5 ml aliquots. A volume of 20–25 ml of 0.25% (Levo) bupivacaine or 0.2% ropivacaine with or without adjuvants can be used for analgesia on each side depending upon the surgery & requirements.[7,8]

The present study was conducted to assess the effect of dexmedetomidine and dexamethasone as an adjuvant to 0.375% ropivacaine in erector spinae plane block (ESPB) to control postoperative pain after lumbar spine surgery.[9]

Gao et al,[10] conducted a study in which 90 patients who aged 20–65 years were planned to undergo VATLS were involved in this trial. VAS score was lower in the ropivacaine with dexmedetomidine group at wake up and at postoperative 2, 4, 12, and 24 hours. The mean duration of sensory blockade was significantly longer in the RM group. The first request to use the PCA machine in the RM group was extended significantly compared with that in the ropivacaine alone (R) group and ropivacaine with dexamethasone (RS) group ($P<0.001$). Total PCA use, post-surgical hospital stay, and rate of rescue analgesia use in the RM group were lessened significantly compared with those in the R and RS groups.

Similar to these prior study findings, we found that the duration of surgery and intraoperative consumption of fentanyl was not significantly different among groups. Postoperative tramadol consumption and rescue analgesic requirement, and duration of hospital stay were significantly less in group **III** as compared to group **I** and **II** thus proving the efficacy of dexmedetomidine as a better adjuvant to ropivacaine than dexamethasone, in erector spinae plane block. Earlier studies have provided plausible mechanisms linked with the action of dexmedetomidine to improve blockade efficacy.[11,12]

Conclusion

The authors found that dexmedetomidine was found to be better than dexamethasone as an adjuvant to ropivacaine in the Erector spinae plane block for lumbar spine surgery.

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