

Comparative Study of Isobaric Ropivacaine (0.75%) and Isobaric Ropivacaine (0.75%) with Adjuvants Clonidine and Dexmedetomidine Administered Intrathecally in Adult Patients Undergoing Lower Limb Surgeries

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How to cite this article:

Britto Sabu, Gunaseelan Sivasamy, Raghuraman MS. Comparative Study of Isobaric Ropivacaine (0.75%) and Isobaric Ropivacaine(0.75%) with Adjuvants Clonidine and Dexmedetomidine Administered Intrathecally in Adult Patients Undergoing Lower Limb Surgeries. Indian J Anesth Analg. 2020;7(4):930-933.

Abstract

Spinal anesthesia is unparalleled in the way a small dose of local anesthetic, virtually devoid of systemic pharmacologic effect, can produce profound surgical anesthesia. The quality and duration of analgesia is improved when a local anesthetic is combined with alpha 2 adrenergic agonist. Here we evaluate the clinical effects of the adjuvants, α_2 agonists-dexmedetomidine 5 mcg and clonidine 15 mcg in conjunction with intrathecal isobaric ropivacaine 0.75% for lower limb surgeries and assessing 1. The onset and duration of sensory block 2. The onset and duration of motor block 3. The duration of analgesia 4. Hemodynamic changes.

Material and Methods: Prospective study was done on patients undergoing lower limb surgeries under neuraxial block were split into three equivalent groups. Group RR: subjects received 3 ml of isobaric Ropivacaine 0.75% with sterile water 0.1 ml (total=3.1 ml), Group RC: subjects 3 ml isobaric Ropivacaine 0.75% with clonidine 15 mcg (total=3.1 ml), Group RD: subjects 3 ml isobaric Ropivacaine 0.75% with dexmedetomidine 5 mcg (total=3.1 ml).

Result: Statistical analysis shows significant difference in onset, duration of sensory and motor block and duration of analgesia among three Groups, Group RD, RC and RR. The time of onset of sensory, motor block was earlier and duration of sensory, motor block was longer and duration of analgesia (time to requirement of first rescue analgesic) prolonged in Group RD as compared to Group RC and Group RR.

Conclusion: Dexmedetomidine with isobaric ropivacaine 0.75% produces more rapid onset of sensory and motor block, prolonged duration of sensory and motor block and longer duration of analgesia than clonidine with isobaric ropivacaine 0.75% and isobaric ropivacaine 0.75% alone intrathecally.

Keywords: Ropivacaine; Clonidine; Dexmedetomidine; Sensory blockade; Motor blockade; Local anesthetic.

Introduction

Spinal anesthesia is a customary regional anesthetic technique, having a decent safety-efficacy profile in lower limb surgeries. There have been time and again efforts to improve its efficacy and utility even for longer duration surgeries. Ropivacaine, a amide local anesthetic, is considered to have a

better tolerability profile for neuro-cardiovascular tissues and has been signaled as an alternative to bupivacaine. Hyperbaric ropivacaine though produces a more consistent nerve block than isobaric preparation, unavailability of commercial hyperbaric preparations have invited investigations on addition of adjuvant to isobaric ropivacaine to overcome its drawbacks.

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The alpha agonists like clonidine, dexmedetomidine and ephedrine, are assuming greater importance as anesthetic adjuvants to local anesthetics and opioids. Dexmedetomidine and clonidine owing to their alpha-2 adrenergic agonistic action has a synergistic effect on local anesthetics. They act by binding to pre synaptic C - fibers and postsynaptic dorsal horn neurons. Their analgesic action is a result of depression on the release of C - fiber neurotransmitters and hyper polarization of postsynaptic dorsal horn neurons. The prolongation of sensory effect of local anesthetics may result from synergism between local anesthetic and α_2 -adrenoceptor agonist, whereas the prolongation of the motor block may result from the attachment of α_2 -adrenoceptor agonists to motor neurons in the dorsal horn. Clonidine is a well established adjuvant to intrathecal local anesthetics. Dexmedetomidine has been used as adjuvant to spinal anesthetics in doses ranging from 3 to 10 μg in humans without any evidence of neurologic deficits after 2-week follow-up.

Materials and Methods

This study was conducted in Sri Venkateshwaraa Medical College Hospital and Research Centre after approval of the medical college ethical board and informed written consent was taken from all patients. A double blinded randomized clinical study was performed on ninety male and female adults patients (ASA-1&2), posted for upper limb surgeries during the period of December 2017 to January 2019. The randomization was made

by envelope technique which was sealed one. Analysis of statistics was done with software SPSS V(23) and Anova was used to compare the means between Groups and p-value less than 0.05 was considered statistically significant. Prospective study by blinding both study performer and patients was done and patients undergoing elective lower limb surgeries were randomly divided into three equal Groups and each Group consisting of 30 subjects, *Group RR*: subjects received 3 ml of isobaric Ropivacaine 0.75% with sterile water 0.1 ml (total=3.1ml), *Group RC*: subjects 3 ml isobaric Ropivacaine 0.75% with clonidine 15 mcg (total=3.1 ml), *Group RD*: subjects 3 ml isobaric Ropivacaine 0.75% with dexmedetomidine 5 mcg (total=3.1 ml). Following parameters including 1.The onset and duration of sensory block 2. The onset and duration of motor block 3. The duration of analgesia 4. Hemodynamic changes (Pulse rate, SBP, DBP, RR, SpO₂) between three Groups were recorded.

Result

Statistical analysis shows significant difference in onset of S&M blockade (Table 1), high significance in duration of S&M blockade between RR, RC and RD groups (p=0.000) (Table 2). High Statistical significance was seen in analgesia duration (P=0.000) and duration till requirement of first rescue analgesia (p=0.0001) among RR, RC and RD groups (Table 3) this values are shown in tables below. No significant difference in HR, SBP, DBP (p>0.05) among three groups.

Table 1: Onset of sensory and motor block in three groups (Minutes)

Onset	Group (RR)	Group (RC)	Group (RD)	p-value
S- Block	7.58± 0.85 min	5.15± 0.99 min	3.56 ± 1.01 min	p-value=0.000
M- Block	11.23±1.79 min	8.07±1.18 min	3.56 ±1.10 min	p-value=0.000

S- sensory, M- motor

Table 2: Sensory and motor block duration in three groups

Duration	Group (RR)	Group (RC)	Group (RD)	p-value
S- Block	123.03±8.96 min	186± 12.27 min	219.53±16.34 min	p-value =0.000
M- Block	111.63±8.96 min	163.57±9.95 min	197.17±17.28 min	p-value =0.000

Table 3: Duration of analgesia and Rescue analgesia among three groups

Duration	Group (RR)	Group (RC)	Group (RD)	p-value
Duration of Analgesia	220.60± 7.16 min	330.23±13.95 min	364.80±15.37 min	p-value = 0.000
Time of Rescue Analgesia	220.60± 7.16 min	330.23±13.95 min	364.80±15.37 min	p-value = 0.000

Discussion

Spinal anesthesia is a customary regional anesthetic technique, having a decent safety-efficacy profile in lower limb surgeries. There have been time and again efforts to improve its efficacy and utility even for longer duration surgeries. Ropivacaine, a amide local anesthetic, is considered to have a better tolerability profile for neuro cardiovascular tissues and has been signalled as an alternative to bupivacaine.^{10,11} Hyperbaric ropivacaine though produces a more consistent nerve block than isobaric preparation, unavailability of commercial hyperbaric preparations have invited investigations on addition of adjuvant to isobaric ropivacaine 0.75% to overcome its drawbacks. The alpha agonists like clonidine, dexmedetomidine and ephedrine, are assuming greater importance as anesthetic adjuvants to local anesthetics and opioids.⁹ Dexmedetomidine and clonidine owing to their alpha-2 adrenergic agonistic action has a synergistic effect on local anesthetics.¹² Duration of S and M blockade was significantly extended in study done by Kujur S et al. 2012¹, Kanazi GE et al. in 2006², Gupta R et al. in 2011³, Singh AK et al. in 2015⁴, Al-Mustafa MM et al. in 2008⁵, Ravipati P et al. in 2017.⁶

Dexmedetomidine is the recent drug which acts on α_2 -adrenergic receptors in the dorsal horn of the spinal cord to produce analgesic effects⁷, Clonidine is a partial α_2 -adrenergic agonist used intrathecally, with a well established record of efficacy and safety. Dexmedetomidine action is mainly through the alpha 2 receptor which is adrenergic in nature.⁸ The selectivity to this receptor is very high and acts as agonist. The activity at alpha 1 receptor and alpha 2 receptor is 1:220 times for clonidine and 1:1620 times for dexmedetomidine.

In our current study the time of onset of sensory, motor block was earlier and duration of sensory, motor block was longer and duration of analgesia (time to requirement of first rescue analgesic) prolonged in Group RD as compared to Group RC and Group RR. Among Group RC and Group RR, Group RC had earlier onset of sensory, motor block and longer duration of sensory, motor block and prolonged duration of analgesia. Among Group RC and Group RD, Group RD had earlier onset of sensory, motor block and longer duration of sensory, motor block and prolonged duration of analgesia.

Conclusion

Dexmedetomidine with isobaric ropivacaine 0.75% produces more rapid onset of sensory and

motor block, prolonged duration of sensory and motor block and longer duration of analgesia than clonidine with isobaric ropivacaine 0.75% and isobaric ropivacaine 0.75% alone intrathecally. Both dexmedetomidine 5 mcg or Clonidine 15 mcg did not produces any significant hemodynamic instability or sedation. Hence we conclude that dexmedetomidine 5 mcg with isobaric ropivacaine 0.75% is better a adjuvant than clonidine 15 mcg with isobaric ropivacaine 0.75% and isobaric ropivacaine 0.75% alone intrathecally.

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