

Comparison between Intrathecal Isobaric Bupivacaine 0.5% with Isobaric Ropivacaine 0.75% for Lower Limb Orthopaedic Surgeries: A Double Blind Randomized Controlled Study

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ABSTRACT

Introduction: Spinal anaesthesia is probably the most widely used regional anaesthetic procedure in routine clinical anaesthesiology practice. It provides rapid onset, consistent sensory blockade and adequate muscle relaxation for all types of surgery below the level of umbilicus. The present study compared effects of plain Ropivacaine 0.75% and plain Bupivacaine 0.5% on duration of sensory and motor block for lower limb orthopaedic surgery.

Material and methods: A randomized double blind prospective controlled study involving 100 patients aged 20-50 years of ASA I and II scheduled for receiving subarachnoid block for lower limb orthopaedic surgery was conducted. The patients were divided into two groups of 50 each. Group I was given 3ml, 0.5% isobaric bupivacaine (15mg) and Group II was given 3ml, 0.75% isobaric ropivacaine (22.5mg). In this study we assessed three parameters, namely- onset time, sensory regression and motor blockade, intraoperative haemodynamic parameters and complications. Result between two groups were compared using unpaired t-test. P-value <0.05 was considered significant.

Results: The duration of sensory blockade was longer and duration of motor blockade was shorter with 0.75% ropivacaine as compared to 0.5% bupivacaine. Also the 0.75% ropivacaine provide more haemodynamic stability as compared to 0.5% bupivacaine.

Conclusion: Ropivacaine 0.75% via subarachnoid block for lower limb orthopaedic surgery provides lesser duration of motor blockade while providing adequate surgical analgesia and better haemodynamic stability in short duration day care surgery.

Keywords: Isobaric Ropivacaine, 0.75% Ropivacaine, Isobaric Bupivacaine, 0.5% Bupivacaine, Lower Limb Orthopaedic Surgery

INTRODUCTION

Subarachnoid block is the most commonly practised regional anaesthetic technique for all types of surgeries below the level of umbilicus and is relatively easier, requires less equipment and very cost effective in developing countries like India. It also provides faster onset of motor and level of sensory block with adequate muscle relaxation

Bupivacaine is the most commonly used drug for spinal anaesthesia, but also has many undesirable effects such as hypotension, bradycardia, longer duration of motor blockade, cardiotoxicity and central nervous system toxicity.¹⁻⁴

Ropivacaine is a local anaesthetic with local anaesthetic properties similar to those of bupivacaine. It is an amide and pure S (-) enantiomer of propivacaine which is effective and safe for regional anaesthetic techniques such as epidural, brachial plexus block and peripheral nerve block. Ropivacaine provides effective spinal anaesthesia for lower limb orthopaedic surgery. It provides lesser duration of motor blockade and has a better

safety profile.⁵ Which is helpful for short duration surgeries and provides early ambulation. This study was done to compare the safety and efficacy of intrathecal plain bupivacaine 0.5% and plain ropivacaine 0.75% in patients undergoing lower limb orthopaedic surgery.

MATERIAL AND METHODS

This randomized prospective controlled study was conducted after approval from institutional ethics committee. A well explained and informed consents in written form were taken. Study comprises of 100 patients both males and females aged between 20-50 years, belonging to ASA I and II physical status scheduled for lower limb orthopaedic surgery were included in the study and were divided into two groups of 50 each. Exclusion criteria: Patient's refusal, any contraindication of spinal anaesthesia.

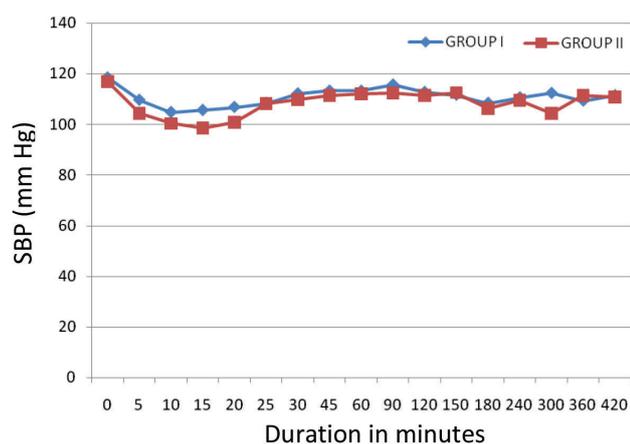
Randomization was done in two groups using sealed envelop method. After securing a suitable peripheral vein all patients were administered 500ml ringer lactate solution along with 50mg i.v. ranitidine and 4mg i.v. ondansetron. The parameters monitored were non invasive blood pressure, pulse rate, SpO₂ and ECG.

Under all aseptic precautions spinal anaesthesia was given in patient placed in lateral position with affected limb uppermost via midline approach in L₃- L₄ space via 25G Quincke's tip spinal needle after local infiltration with 2ml of lignocaine 2%, on confirmation of free flow of CSF 3 ml study drug was injected over 10s. Group A received plain 0.5% (3ml) Bupivacaine, Group B received 0.75% (3ml) ropivacaine. The spinal needle was removed and patient placed supine. Supplemental oxygen was given at 3l/min with oxygen mask. A close monitoring was done for pulse rate, blood pressure, respiratory rate and SpO₂ at an interval of 5 minutes for first 30 minutes then at an interval of 15 minutes till 180 minutes. Fall of systolic blood pressure by >30% of baseline is considered as hypotension or <90mm of Hg was treated with intravenous mephentermine 6mg and i.v. fluids as required. Bradycardia defined as heart rate <60/minute was treated with i.v. atropine 0.3-0.6mg. Incidence of side effects such as respiratory depression, nausea, and vomiting was

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Graph-3: Comparison of pulse rate between two groups

cardiovascular complications, better post-operative pain management, lower incidence of deep vein thrombosis and pulmonary embolism.⁷ Newly introduced long acting amide local anaesthetic like Ropivacaine blocks A δ and C fibres (pain) more completely than A α (motor) fibres and among A δ and C fibres it blocks C fibres faster than A δ fibres.⁸

Our study is aimed to compare relative anaesthetic efficacy and safety of plain bupivacaine vs ropivacaine for spinal anaesthesia in ASA Grade I and II between age group 20-50 years as also done by Halena Kallio et al⁹, D.A. McNamee¹⁰, A.M. McClelland et al¹¹, and Jack W Vankleef et al¹² In our present study we performed subarachnoid block with the patient placed in lateral position with affected limb uppermost, which was also done by A.M. McClelland et al¹¹ and M.C. Shesky et al¹³ and they explained that this solution is slightly hypobaric which explain the greater cephalad spread when it is injected in lateral position with affected limb uppermost. In our study we use bupivacaine 0.5%, 3ml (15mg) and ropivacaine 0.75%,3ml (22.5mg) as also used by Jack Vankleef et al¹² and Shesky et al.¹³ In our present study there was slight reduction in mean arterial pressure after spinal block in both the groups, which however was significant in Bupivacaine group. There was decrease in heart rate after spinal block in both the groups however there were no significant inter group differences which were also reported by M.Mantouvalou et al¹⁴, Shesky et al¹³, Mc Namee et al.¹⁰ No change in respiratory rate were reported in two groups.

In our study onset of sensory block took 6.36 ± 1.76 minutes for 0.5% Bupivacaine and 6.16 ± 1.72 minutes for 0.75% ropivacaine and there was no intergroup significance. The highest level of sensory block in 0.75% ropivacaine achieved was T₁₀ as also reported by Van Kleef et al.¹² However in 0.5% Bupivacaine we found slight higher level of block i.e. T₉ dermatome which was not statistically significant which was similar to the study done by D.A. Mc Namee et al.¹³

Sensory level achieved in our study was in contrast to study done by Shesky Mc et al.¹³ The time to achieve complete motor blockade (Modified Bromage scale) was shorter in Bupivacaine group (11.50 ± 3.272) than ropivacaine group (15.39 ± 3.166). Total duration of motor block was significantly prolonged in Bupivacaine group which coincide with the study done by Van Kleef et al.¹² This may be explained by, lesser lipid solubility of ropivacaine may cause this drug to penetrate the large

myelinated A fibres more slowly than the more lipid soluble Bupivacaine.

Intraoperative hypotension is more in Bupivacaine group than in Ropivacaine group. No significant changes reported in heart rate, SpO₂, respiratory rate, nausea and vomiting, which was also supported by studies of Mc Namee DA et al¹⁰, Malinovsky JM et al¹⁵, Gautier PE et al.¹⁶

CONCLUSION

We conclude from this study that Ropivacaine 0.75% via subarachnoid block provides lesser duration of motor blockade and more duration of sensory blockade while providing adequate surgical analgesia and better hemodynamic stability in short duration day care surgeries as compared to 0.5% Bupivacaine.

REFERENCES

- Hodgson PS, Neal JM, Pollock JE, Liu SS. The neurotoxicity of drugs given intrathecally (spinal) *Anesth Analg.* 1999;88:797-809.
- Barash PG, Cullen BF, Stoelting RK, editors. Philadelphia: Lippincott Williams and Wilkins; 2001. *Clinical Anaesthesia*; pp. 451-66.
- Hiller A, Rosenberg PH. Transient neurological symptoms after spinal anaesthesia with 4% mepivacaine and 0.5% bupivacaine. *Br J Anaesth.* 1997;79:301-5.
- HAMPL KF, SCHNEIDER MC, DRASNER K. Toxicity of spinal local anaesthetics. *Curr Opin Anaesthesiol.* 1999;12:559-64.
- McConachie I, McGeachie J, Barrie J. Regional anaesthetic techniques. In: Thomas EJ, Knight PR, editors. *Wylie and Churchill Davidson's - A Practice of Anesthesia.* London: Arnold. 2003;37:599-612.
- Murphy KR, Myers B. 2nd ed. Mahwah, NJ: Lawrence Erlbaum Associates; 2004. *Statistical power analysis: A simple and general model for traditional and modern hypothesis tests*
- Modig J, Borg T, Karstorm G, Maripuu E, Sahlstedt B. Thromboembolism after total hip replacement; role of epidural and general anesthesia. *Anesthesia and Analgesia.* 1983;62:174-80.
- Rosenberg et al. Absorption of Bupivacaine, Lignocaine, Etidocaine, Ropivacaine into n-heptane, rat sciatic nerve and human extradural and subcutaneous fat. *British journal of anaesthesia.* 1986;58:310-314.
- Helena Kallio et al. A Comparison of intrathecal Plain Solutions Containing Ropivacaine 20 or 15 mg Versus Bupivacaine 10 mg. *Anesth Analg.* 2004;99:713-7.
- McNamee DA, Parks L, McClelland AM, et al. Intrathecal ropivacaine for total hip arthroplasty: double-blind comparative study with isobaric 7.5 mg ml⁻¹ and 10 mg ml⁻¹ solutions. *Br J Anaesth.* 2001;87:743-7.
- McClelland AM, McNamee DA, Scott S, et al. Spinal anaesthesia: comparison of plain ropivacaine 5 mg ml⁻¹ with bupivacaine 5 mg ml⁻¹ for major orthopaedic surgery. *Br J Anaesth.* 2002;89:702-6.
- Vankleef et al. Spinal anesthesia with ropivacaine. A double blinded study on the efficacy and safety of 0.5% and 0.75% solutions in patients undergoing minor lower limb surgery. *Anesthesia analgesia.* 1994;78:1125-1130.
- Shesky M.C et al. A dose response study of Bupivacaine for spinal anaesthesia. *Anesth Analg.* 1983;62:931-5.
- Mantouvalou M. et al. Spinal anesthesia: Comparison of plain ropivacaine, bupivacaine and levobupivacaine for

- lower abdominal surgery. *Acta Anaesth. Belg.*, 2008;59: 65-71.
15. Malinovsky JM, Charles F, Kick O, et al. Intrathecal anesthesia: ropivacaine versus bupivacaine. *Anesth Analg.* 2000;91:1457-60.
 16. Gautier P. E., De Kock M., Van Steenberge A., Poth N., Lahaye-Goffart B., Fanard L., Hody J. L., Intrathecal ropivacaine for ambulatory surgery. A comparison between intrathecal bupivacaine and intrathecal ropivacaine for knee arthroscopy, *Anesthesiology.* 1999;91:1239-45.
 17. Feldman HS, Covino BG. Comparative motor-blocking effects of bupivacaine and ropivacaine, a new amino amide local anesthetic, in the rat and dog. *Anesth Analg.* 1988;67: 1047-52.
 18. Stienstra R et al. Spinal anaesthesia with plain Bupivacaine 0.5% regression of sensory and motor blockade with different temperatures of anaesthetic solution. *Anaesth Analg.* 1989;69:593-7.
 19. Rutten et al. Hemodynamic and central nervous system effects of intravenous bolus dose of Lignocaine, ropivacaine, Bupivacaine in sheep. *Anesthesia Analgesia.* 1989;69:291-299.
 20. Boztuğ N, Bigat Z, Karsli B, Saykal N, Ertok E. Comparison of ropivacaine and bupivacaine for intrathecal anesthesia during outpatient arthroscopic surgery. *J Clin Anesthesia.* 2006;18;521.

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