

Comparative Clinical Study of 0.5% Hyperbaric Bupivacaine alone and 0.5% Hyperbaric Bupivacaine with Midazolam Intrathecally for Lower Limb Orthopaedic Surgeries

M. Venkata Ganesh¹, P.V.S. Lavanya²

ABSTRACT

Introduction: Subarachnoid blockade is the common form of central neuraxial blockade performed for lower limb orthopaedic surgeries. In order to maximize quality of anaesthesia and post-operative analgesia, a number of adjuvants have been added to spinal local anaesthetics. Intrathecal midazolam abolishes pain of somatic origin, produces selective sensory block, and depresses somatosympathetic reflexes without any neurotoxicity. It potentiates the blocking actions of local anaesthetics. Hence the present study is conducted to evaluate the efficacy and analgesic effect of mixture of spinal midazolam-bupivacaine as compared to bupivacaine alone in patients under going lower limb orthopedic surgery.

Material and methods: The present study is conducted after ethical clearance in tertiary hospital in 100 patients aged between 18 to 60 years belonging to ASA Grade I and II of both the sexes posted for elective orthopedic surgeries. The control (B) group received 2.5mL of 0.5% hyperbaric bupivacaine plus 0.2mL of normal saline, and the preservative free midazolam group (M) received 2.5mL of 0.5% hyperbaric bupivacaine plus 1mg of midazolam in 0.2mL [preservative free]. The sensory, motor characteristics and haemodynamic variables were studied. The results were statistically analyzed using student-t test.

Results: The mean time of onset of the block is reduced, the mean duration of sensory blockade is prolonged and the mean duration of analgesia is prolonged in midazolam group. No significant complications recorded.

Conclusion: From the present study it can be concluded that addition of intrathecal midazolam with bupivacaine significantly improves the quality of anaesthesia, duration of analgesia without prolonging the recovery from the anaesthesia.

Keywords: Subarachnoid, Intrathecal, Midazolam, Bupivacaine, Anaesthesia, Analgesia

surgeries. The ensuing nerve block ensures the patient's well-being, while motor block facilitates the surgeon's work. The 0.5% hyperbaric bupivacaine is the most commonly used drug. It produces longer duration of anaesthesia with good muscle relaxation. It provides effective pain relief in initial post-operative period.

In order to maximize postoperative analgesia, a number of adjuvants¹ have been added to spinal local anaesthetics. Morphine prolongs the postoperative analgesia but is associated with major side effects, in particular delayed respiratory depression. The other adjuvants like clonidine, ketamine have also been tried but none has become stabilized in regular clinical practice because of their adverse effects.

The subarachnoid midazolam has been used in humans since 1986 and doses up to 2 mg have been described. It abolishes pain of somatic origin, produces selective sensory block and blocks somatosympathetic^{2,3} reflexes without any neurotoxicity. The subarachnoid midazolam potentiates the blocking actions of local anaesthetics. It improves the quality of sensory and motor block, without prolonging the time of recovery. It also provides prolonged postoperative pain⁴ relief without producing sedation. The subarachnoid midazolam is also devoid of complications such as bradycardia, hypotension, postoperative nausea and vomiting, pruritus, urinary retention, and neurotoxicity. The present study was conducted to evaluate the efficacy and analgesic effect of mixture of midazolam-bupivacaine as compared to bupivacaine alone in patients undergoing lower limb orthopaedic surgery under subarachnoid block.

MATERIAL AND METHODS

The present study was conducted after ethical clearance and informed consent in tertiary hospital in 100 patients aged between 18 to 60 years belonging to ASA Grade I and II of both the sexes posted for elective orthopedic

INTRODUCTION

Regional anesthesia for orthopaedic lower limb surgery is considered generally to be safer than general anaesthesia. It avoids general anesthesia related problems such as polypharmacy, airway manipulation, misplacement of endotracheal tube, hypo or hyperventilation, vomiting, pulmonary aspiration. It reduces surgical stress and attenuates increase in plasma catecholamine and other hormones. Regional anaesthesia gives intra and postoperative pain relief with full preservation of mental status and normal reflexes. The subarachnoid blockade is the common form of central neuraxial blockade performed for lower limb orthopaedic

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How to cite this article: M. Venkata Ganesh, P.V.S. Lavanya. Comparative clinical study of 0.5% hyperbaric bupivacaine alone and 0.5% hyperbaric bupivacaine with midazolam intrathecally for lower limb orthopaedic surgeries. International Journal of Contemporary Medical Research 2017;4(8):1644-1647.

surgeries. The control (B) group received 2.5mL of 0.5% hyperbaric bupivacaine plus 0.2 mL of normal saline, and the preservative free midazolam group (M) received 2.5 mL of 0.5% hyperbaric bupivacaine plus 1mg of midazolam in 0.2 mL [preservative free]. The sensory, motor characteristics and haemodynamic variables were studied.

The patients were randomly allocated by simple randomization in to control group (B) and midazolam group (M), each group consisting of 50 patients.

The monitoring was established with electrocardiography display, pulse oximetry, and non-invasive blood pressure. The baseline pulse rate, blood pressure, respiratory rate, oxygen saturation and ECG were recorded in each patient before subarachnoid block. A suitable intravenous line with 18 G intravenous cannula was secured and preloaded with 500mL of Ringer lactate solution.

Under strict aseptic precautions lumbar puncture was performed at L3-4 interspace with 23G Quinke's needle, after free flow of cerebrospinal fluid, control (B) group received 2.5mL of 0.5% hyperbaric bupivacaine plus 0.2mL of normal saline, and the midazolam group (M) received 2.5mL of 0.5% hyperbaric bupivacaine plus 1mg of midazolam in 0.2mL.

STATISTICAL ANALYSIS

Microsoft office 2007 was used for the analysis. Descriptive statistics were used for the quantitative analysis of data. Paired t test was used for the comparison.

RESULTS

The table-1 shows time of Onset of Sensory Block. In group B the range for onset of sensory blockade is 4 to 6 minutes with mean onset time being 4.76 ± 0.76 minutes. In the group M the range for onset of sensory blockade is 2 to 6 minutes with a mean onset time of 3.68 ± 1.06 minutes. The t value is 5.977 and p value being $p < 0.05$, hence statistically significant.

Table-2 shows the duration of sensory blockade in both group B and group M. the mean duration of sensory blockade in group B is 88.96 ± 2.98 minutes were as in group M, it is 119.70 ± 8.93 minutes, $p < 0.05$ hence statistically significant.

The table-3 shows the duration of analgesia in both the groups. In group B, the mean duration of analgesia is 124.86 ± 7.25 minutes with a range of 110 to 142 minutes.

In group M, the mean duration of analgesia is 247 ± 25.74 minutes with a range of 195 to 302 minutes (Graph-1). The duration of analgesia has been increased from 124.86 minutes to 247.82 minutes. The p value is $p < 0.05$, hence statistically highly significant.

Mean Heart Rate

The mean heart rate in both group B and group M is not significant

DISCUSSION

The subarachnoid blockade is the common form of central neuraxial blockade performed for lower limb orthopaedic surgeries. The ensuing nerve block ensures the patient well-being, while motor block facilitates the surgeon's work.

Group	Onset of Sensory Blockade		
	Range	Mean	SD
B	4-6	4.76	0.72
M	2-6	3.68	1.06
t = 5.977, p < 0.05 significant			

Table-1: Onset of Sensory Blockade

Group	Duration of Sensory Blockade (minutes)		
	Range	Mean	SD
B	85 - 98	88.96	2.98
M	06 - 140	119.70	8.93
t = -23.079; p < 0.05 statistically significant			

Table-2: Duration of Sensory Blockade(minutes)

Group	Duration of analgesia(minutes)		
	Range	Mean	SD
B	110 - 142	124.86	7.25
M	190 - 302	247.82	25.74
t = -32.509, P value < 0.05 Significant			

Table-3: Duration of analgesia

0.5% hyperbaric bupivacaine produces longer duration of anaesthesia with good muscle relaxation. It provides effective pain relief in initial post-operative period.⁵ In order to maximize post-operative analgesia⁶, a number of adjuvants have been added to spinal local anaesthetics. Midazolam is a newer water soluble imidazo-benzodiazepine^{7,8} derivative which has been tried since early 1980's. It had been tried widely and antinociceptive effect with neurological safety had been well established in animals and humans.

The present clinical study is a randomized prospective study in 100 patients belonging to age group 18 to 60 years of both the sexes and of ASA Grade I and II who were scheduled to undergo various elective lower limb orthopaedic surgeries under subarachnoid anaesthesia. The patient group B received 2.5mL of 0.5% hyperbaric bupivacaine with 0.2mL of normal saline and the patient Group M received 2.5mL of 0.5% hyperbaric bupivacaine with 0.2mL (1 mg preservative free) midazolam intrathecally.⁹

The study conducted by Batra Y.K et al¹⁰ showed that the duration of sensory blockade being increased from 229.8 ± 41.4 minutes in bupivacaine group to 267.6 ± 67.38 minutes in midazolam group with p value < 0.05 and thus, being statistically significant.

In present study the duration of sensory blockade was prolonged from is 88.96 ± 2.98 minutes in group B to 119.70 ± 8.93 minutes in Group M and it was found to be statistically significant as $p < 0.05$.

Midazolam is a potent short acting benzodiazepine in aqueous solution has been reported to provide antinociceptive effect in animals and in humans.

Batra Y.K et al¹⁰ M.H Kim and Y.M. Lee,¹¹ Anjana Sen. et al.¹², Nidhi Agarwal et al,¹³ and Vaswani et al,¹⁴ Bharti N et al¹⁵ and showed that the mean duration of analgesia significantly prolonged in patients receiving intrathecal midazolam.^{16,17}

In present study the duration of analgesia was prolonged from 124.86 ± 7.25 minutes in bupivacaine group to 247

± 25.74 minutes in midazolam group. This is statistically highly significant as p value is 0.000.

Midazolam¹⁸ acts through the GABA receptors¹⁹ which are present in the dorsal horn of spinal cord.^{20,21} Administration of exogenous benzodiazepines in to the CSF around the spinal cord reached the GABA receptors²² in the high concentration and could have potentiated the effects of local anaesthetics. Therefore, benzodiazepines can gain access to the analgesic system mediated by Gamma amino butyric acid^{23,24}

There was no statistical difference observed between the two groups with regards to complications, such as hypotension, bradycardia, post-operative nausea and vomiting²⁵, respiratory depression, urinary retention and signs of neurotoxicity.

CONCLUSION

In the present study, the sensory and motor characteristics of 2.5mL 0.5%hyperbaric bupivacaine alone and 2.5mL 0.5%hyperbaric bupivacaine with 1mg [0.2ml] of intrathecal midazolam were studied.

The results of the present study suggest that the combination of inj.midazolam 1mg with inj. bupivacaine 0.5% (hyperbaric): Decreases the onset time of sensory blockade, prolongs the duration of analgesia, does not prolong the motor blockade, does not prolong the sympathetic recovery, does not associate with any significant hemodynamic changes, does not increase the incidence of complications such as bradycardia, drowsiness, hypotension, post-operative nausea and vomiting, urinary retention and neurotoxicity.

In conclusion, it can be inferred that inj. midazolam 1 mg in combination with inj.bupivacaine 0.5% hyperbaric can be safely administered intrathecally for better postoperative analgesia.

The incidence of the complications was also compared between two groups.Both the groups were comparable with respect to age, sex, type of surgery, maximum level of block, onset quality and duration of motor block.

It has been observed that, the addition of 1mg of preservative free midazolam to 0.5% hyperbaric bupivacaine reduces the onset time of sensory block and prolongs the duration of analgesia with no increase in the incidence of complications.

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Source of Support: Nil; **Conflict of Interest:** None

Submitted: 08-07-2017; **Accepted:** 14-08-2017; **Published:** 25-08-2017