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Original Research Article

Prospective, Randomized, Controlled, Double Blinded Assessment of the Effect of Intravenous Dexmedetomidine Infusion on Subarachnoid Block with Bupivacaine in Inguinal Herniorrhaphies

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Abstract

Aim: The Effect of Intravenous Dexmedetomidine Infusion on Subarachnoid Block with Bupivacaine in Inguinal Herniorrhaphies

Material and methods: This prospective, randomized, controlled, double blinded study was carried out in the Department of Anaesthesiology, NMCH, Patna, Bihar, India for 1 year. All the patients were dived in two groups. Group A: received Spinal Bupivacaine 0.5% (Heavy) and intravenous Dexmedetomidine 1µg/kg bolus infusion in 20 mL (syringe) over a period of 10 minutes followed by 0.5µg/kg over a period of one hour in 50 mL (syringe). Group B: Received Spinal Bupivacaine 0.5% (Heavy) and normal saline Infusion. The volume of intravenous bolus dose for groups A and B was made same (20 mL). For loading dose in group, A, Dexmedetomidine 1µg/kg taken, made to 20 ml with distilled water & for group B 20ml of normal saline was taken. The volume of intravenous maintenance dose for group A and B was made the same (50 mL).

Results: Mean time of onset of sensory blockade in group A is 3.58 mt and in group B is 3.58. It is not statistically significant with p value >0.05. Mean time to achieve maximum sensory blockade in group A is 12.06 mt and in group B is 11.62mts. It is not statistically significant with p value >0.05. Mean Time of first Analgesia is compared in two groups. Time of first analgesia in group A is 353.4 mts and for group B IS 185.28mts. It is statistically significant with p value<0.001. Whereas mean pain score at 60mt, 2hr, 3hr, 4hr, 5hr in group A is 3.3, 17.3, 26.5, 32.18, 39.10 and for group B is 10.10, 38.5, 48.67, 50.10. At 60 minutes the mean pain score for group A was 3.3 and for group B was 10.10 which was again showed significant difference between two groups. All the patients in group B showed a pain score of >50 before 4hr and received rescue analgesia. At 4hr the mean pain score in group A was only 32.18. At 60mt, 2hr, 3hr, 4hr, 5hr, 6hr, 7hr, 8hr mean pain score in group A is increased from 3.4, 17.4, 26.7, 32.19, 39.29, 45.20, 48.77, 50.20 is observed difference among the groups were statistically significant and that of group A continues to be a superior drug when mean pain scores were compared, then the other group.

Conclusion: Intravenous infusion of dexmedetomidine added to subarachnoid block with bupivacaine shows prolonged analgesia in adult patients, without increasing the incidence of unwanted effects.

Keywords: Dexmedetomidine, Bupivacaine, Herniorrhaphies.

Introduction

In a bid to improve regional anesthesia techniques, many drugs have been tried as sedative agents in patients undergoing lower abdominal surgeries under subarachnoid block [1,4]. All these agents have their own integral merits and demerits and none of them can be considered as an ideal agent for sedation during spinal anesthesia. Therefore, the search for supplementing regional anesthesia with sedative agents seems to be unending Studies have compared propofol and midazolam for achieving faster onset and longer duration [5]. However, patients receiving propofol were three times more likely to have hypotensive episodes which limited the role of propofol as a sedative agent, especially in cardiac patients. Newer alpha-2 agonist dexmedetomidine has emerged as a wonderful drug in anesthesia practice since last one and a half decade [6].

Very few studies have been done with dexmedetomidine as a sedative agent to supplement subarachnoid block. As such there is a paucity of literature on the effect of dexmedetomidine on overall block characteristics of regional anesthesia.

This study is designed to investigate the effects of intravenous dexmedetomidine on the duration of sensory and motor blockade induced by intrathecal administration of bupivacaine, and its associated adverse events.

Material and methods

This prospective, randomized, controlled, double blinded study was carried out in the Department of Anaesthesiology, NMCH, Patna, Bihar, India for 1 year. Patients of ASA grade I and II, age group 20- 60 yrs, Weight between 65and 75 kg, and Height between 155cm and 175cm were included in this study. Patient refusal to LSAB, History of drug allergy, Patients with coagulation disorders, patient with liver disease, kidney disease, neurologic disorders, cardiovascular disease, Infection at the site of injection and Pregnancy were excluded from the study.

Methodology

A double blind prospective randomized control study was done.80 adults were allocated into two study groups, named A and B using computer generated randomization. An informed, valid, written consent was obtained for conduct of the study. All patients were kept nil by mouth from midnight before surgery and tablet alprazolam (0.01 mg/kg) was administered at bedtime the day before surgery. Intravenous access was established with an 18-gauge cannula and preloading was done with 20 ml/kg lactated Ringer's solution, 20 min before the procedure. A pulse oximeter, noninvasive blood pressure (BP), and electrocardiogram monitor were applied to each patient on arrival to the operating room and baseline parameters were recorded. All the patients were randomly allocated into two groups of 80 each by computer-generated number. The patient and the anesthesiologist were blinded to the treatment group, and all recordings were performed by an anesthesiologist, who was blinded to randomization schedule. An anesthesiologist, who was blinded to the study drug used, documented all the parameters.

Under strict aseptic conditions, subarachnoid block was performed at L3–L4 intervertebral space through midline approach using a 23-gauge Quincke spinal needle. After ensuring free flow of cerebrospinal fluid 0.5% heavy bupivacaine, 15 mg was administered intrathecally. Monitoring will be recorded at 3 minutes interval for the first 10minutes.Thereafter every 5 minutes till the end of surgery.

Group A: received Spinal Bupivacaine 0.5% (Heavy) and intravenous Dexmedetomidine 1µg/kg bolus infusion in 20 mL (syringe) over a period of 10 minutes followed by 0.5µg/kg over a period of one hour in 50 mL (syringe).

Group B: Received Spinal Bupivacaine 0.5% (Heavy) and normal saline Infusion.

The volume of intravenous bolus dose for groups A and B was made same (20 mL). For loading dose in group, A, Dexmedetomidine 1µg/kg taken, made to 20 ml with distilled water & for group B 20ml of normal saline was taken. The volume of intravenous maintenance dose for group A and B was made the same (50 mL).

For maintenance dose in groups A, Dexmedetomidine 0.5µg/kg was taken, made to 50 ml with distilled water & for group B 50ml of normal saline was taken. The investigator would administer the drugs to the patients in each group, as per the random allocation and direction of the guide. The patients in both groups were monitored for the onset of sensory blockade, motor block, and duration of analgesia and for any intra operative side effects. Time of onset of sensory blockade, Time to achieve maximum sensory blockade. Time at which patient complaints of pain, Onset of sensory block was evaluated by pin prick method at every 3 minutes along mid-clavicular line bilaterally till adequate analgesia was attained, Duration of analgesia was recorded every half hour, then every one hour till occurrence of breakthrough pain were studied.

Statistical analysis

Data were analyzed using computer software, Statistical Package for Social Sciences (SPSS) version 10. Data were expressed in its frequency and percentage as well as mean, median and standard deviation. To elucidate the associations and comparisons between different parameters, Chi square ($\chi 2$) test was used as nonparametric test. Student's t test was used as parametric test to compare mean values between two groups. Mann Whitney U test was employed as non- parametric test to compare pain score. For all statistical evaluations, a two-tailed probability of value, < 0.05 was considered significant.

Results

The mean ages in both the groups were comparable and group A registered 52.36 years whereas in group B, mean age was 51.96 years. Mean body weight in group A was 68.12 kg and in group B 68.4 kg.

Mean duration of surgery among group A was 55.4 minutes and in group B 56 minutes. In order to find out the equality of mean age, mean weight and mean duration of surgery Mean systolic blood pressure (SBP) in group A is 109 mmHg and for group B it is 113.56 mmHg. Mean heart rate in group A is 71.40/mt and for group B it is 75.24/mt. It is not statistically significant with p value> 0.05.

Mean time of onset of sensory blockade in group A is 3.58 mt and in group B is 3.58. It is not statistically significant with p value >0.05.

Mean time to achieve maximum sensory blockade in group A is 12.06 mt and in group B is 11.62mts. It is not statistically significant with p value >0.05.

Mean Time of first Analgesia is compared in two groups. Time of first analgesia in group A is 353.4 mts and for group B IS 185.28mts. It is statistically significant with p value<0.001.

Post-operative pain was evaluated by Visual Analogue Scale. The pain score was assessed using visual analogue scale every 30 minutes initially then hourly till the pain score reached a score > 50. For the first 30 minutes none of the cases in both the groups showed any sign of pain.

Whereas mean pain score at 60mt, 2hr, 3hr, 4hr, 5hr in group A is 3.3, 17.3, 26.5, 32.18, 39.10 and for group B is 10.10, 38.5, 48.67, 50.10. At 60 minutes the mean pain score

for group A was 3.3 and for group B was 10.10 which was again showed significant difference between two groups. All the patients in group B showed a pain score of >50 before 4hr and received rescue analgesia. At 4hr the mean pain score in group A was only 32.18. At 60mt, 2hr, 3hr, 4hr, 5hr, 6hr, 7hr, 8hr mean pain score in group A is increased from 3.4, 17.4, 26.7, 32.19, 39.29, 45.20, 48.77, 50.20 is observed difference among the groups were statistically significant and that of group A continues to be a superior drug when mean pain scores were compared, then the other group.

Table 1: Basic profile

Profile	Group A	Group B
Age	52.36 years	51.96
Mean duration of surgery	55.4 minutes	56 minutes
Mean time of onset of sensory blockade	3.58 mt	3.58mt
Mean time to achieve maximum sensory blockade	12.06mt	11.62mt

Table 2: Mean pain score

Pain score	Group A	Group B
1hrs	3.3	10.10
2hrs	17.3	38.50
3hrs hrs	26.5	45.55
4hrs	32.18	48.67
5hrs	39.10	50.10

Discussion

The intrathecal 0.5% hyperbaric bupivacaine is the drug of choice for surgeries lasting for about 120 min. To prolong the duration of spinal anesthesia, various drugs such as magnesium sulfate, neostigmine, midazolam, fentanyl, and clonidine have been used through intrathecal route as adjuvant to local anesthetic. Opioids have attained an integral role as a spinal anesthetic adjuvant, but its addition to local anesthetic solution may lead to pruritus and respiratory depression. Dexmedetomidine, is pharmacologically related to clonidine, has 8 times more affinity for α_2 receptors than does clonidine. It shows a high ratio of specificity for the α_2 receptor (α_2/α_1 1600: 1) compared with clonidine (α_2/α_1 200: 1). It produces sedation and anxiolysis by binding to α_2 receptors in the locus ceruleus, which diminishes the release of norepinephrine and inhibits sympathetic activity, thus decreasing heart rate and blood pressure. Dexmedetomidine has an inhibitory effect on the locus ceruleus (A6 group) located at the brain stem. This supraspinal action could explain the prolongation of spinal anesthesia after intravenous administration of dexmedetomidine. The noradrenergic innervation of the spinal cord arises from the noradrenergic nuclei in the brain stem including the locus ceruleus, the A5, and the A7 noradrenergic nuclei. Neurons in the locus ceruleus are connected to the noradrenergic nuclei in the brain stem. Axon terminals of the noradrenergic nuclei reach lamina VII and VIII of the ventral horns of the spinal cord. The activity of the noradrenergic neurons is decreased by agonists acting at α2-adrenergic receptors on the locus ceruleus cell bodies. Therefore, inhibition of the locus ceruleus results in dis inhibition of the noradrenergic nuclei and exerted descending inhibitory effect on nociception in the spinal cord. These pharmacokinetic parameters apparently are unaltered by age or weight or renal failure, but clearance is a function of height [7]. Dexmedetomidine is now being used off-

label outside of the ICU in various settings, including sedation and adjunct analgesia in the operating room, sedation in diagnostic and procedure units, and for other applications such as withdrawal/detoxification amelioration in adult and pediatric patients [8]. The α2 agonists produce their sedative-hypnotic effect by an action on α2 receptors in the locus caeruleus and an analgesic action at α2 receptors within the locus caeruleus and within the spinal cord [9]. The α2 agonists have the advantage that their effects are readily reversible by α2- adrenergic antagonists (e.g., atipamezole) [10]. The primary site of analgesic action is thought to be the spinal cord.11 Side effects of dexmedetomidine such as hypotension and bradycardia, are dose dependent, Infusion of loading dose over 10 min and then infusing the maintenance dose decreases the incidence of those side effects. The addition of dexmedetomidine as an intravenous adjuvant along with local anaesthetic for achieving the same level of anaesthesia but with a prolonged duration of analgesia which increases the margin of safety and reduces the incidence of unwanted motor blockade. This study was conducted keeping these facts in mind. Patients receiving dexmedetomidine seemed to have greater recall of their stay in the ICU, but all described this as pleasant overall [12]. Al-Mustafa MM et al, in 2011 conducted a study in 48 patients [13]. The aim of this study was to evaluate the prolongation of spinal analgesia by intravenous dexmedetomidine administration after the spinal block and to assess the haemodynamic changes and the level of sedation. They concluded that supplementation of spinal anesthesia with intravenous dexmedetomidine loading dose of 1 μg/kg/hour over 10 minutes and a maintenance dose of 0.5 μg/kg/hour till the end of surgery, produced significantly longer sensory and motor block than spinal anesthesia alone. All patients reached good sedation levels that enabled their cooperation and better operating conditions for the surgeons without significant respiratory depression.

In this study mean pain score at 30 mt in group A is 0 and for group B is 0.5. It is not statistically significant. Whereas mean pain score at 60mt, 2hr, 3hr, 4hr, 5hr in group A is 3.3, 17.3, 26.5, 32.18, 39.10 and for group B is 10.10, 38.5, 48.67, 50.10. At 60 minutes the mean pain score for group A was 3.3 and for group B was 10.10 which was again showed significant difference between two groups. All the patients in group B showed a pain score of >50 before 4hr and received rescue analgesia. At 4hr the mean pain score in group A was only 32.18. At 60mt, 2hr, 3hr, 4hr, 5hr, 6hr, 7hr, 8hr mean pain score in group A is increased from 3.4, 17.4, 26.7, 32.19, 39.29, 45.20, 48.77, 50.20 is observed difference among the groups were statistically significant and that of group A continues to be a superior drug when mean pain scores were compared, then the other group.

In this study mean systolic blood pressure (SBP) in group A is 109 mmHg and for group B it is 113.56 mmHg. No further decreases in SBP occur after infusing dexmedetomidine. It is not statistically and clinically significant with p value > 0.05. Incidence of bradycardia after spinal anaesthesia has been reported to be 12-15 %. In this study mean heart rate in group A is 71.40/mt and for group B it is 75.24/mt. No further decrease clinically significant in heart rate occurred after infusing dexmedetomidine. None of the patients in both study groups received intravenous atropine. It is not statistically and clinically significant with p value > 0.05. Incidence of nausea and vomiting is 5 to20 %. In this study incidence is 5% in group A and also 5% in group B.P value is >0.05. It is not statistically and clinically significant.

Conclusion

Intravenous infusion of dexmedetomidine added to subarachnoid block with bupivacaine shows prolonged analgesia in adult patients, without increasing the incidence of unwanted effects.

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