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ORIGINAL ARTICLE

INFLUENCE OF INTRAVENOUS DEXMEDETOMIDINE INFUSION ON SUBARACHNOID BLOCK WITH BUPIVACAINE IN ADULT INGUINAL HERNIORRHAPHIES

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ABSTRACT: INTRODUCTION: Central neuraxial blocks with local anaesthetics are popular techniques of anaesthesia which have been extensively used for lower abdominal surgery. Subarachnoid block is a simple technique which requires a small dose of local anaesthetic to provide rapid and reliable surgical anaesthesia and minimal risk of drug toxicity. Duration of spinal anaesthesia may be prolonged by addition of opioids, clonidine, neostigmine, or vasoconstrictor agents to the local anesthetic drug for better post-op pain relief. Intrathecal addition of a low dose of α2-agonist like clonidine or dexmedetomidine results in significant prolongation of the duration of the sensory and motor blockade induced by hyperbaric bupivacaine. 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. **AIMS AND OBJEVCTIVES:** To determine effect of intravenous Dexmedetomidine on the duration of analgesia with spinal Bupivacaine for adult patients undergoing herniorrhaphy and to assess the incidence of intra operative side effects, if any. **STUDY SETTING:** This study was done under the department of Anaesthesiology, Azeezia Medical College from March 2013 to October 2013. **STUDY DESIGN:** A double blind prospective randomized control study was done.50 adults aged 20 to 60 years scheduled for herniorrhaphies were allocated into two study groups, named A and B using computer generated randomization. **INTERPRETATIONS AND CONCLUSION:** The duration of analgesia of subarachnoid block with heavy 0.5% bupivacaine with intravenous infusion of saline and dexmedetomidine were compared. Post-operative pain was evaluated by Visual Analogue Scale. Duration of analgesia is the time taken from the administration of the drug to the time when the patient complains of pain of > 50 in Visual Analogue Scale. The duration of analgesia was longest in patients received intravenous dexmedetomidine along with spinal bupivacaine. There were no significant differences between the groups for the time of onset of sensory blockade and time to achieve maximum sensory blockade. Incidence of hypotension and bradycardia were not clinically and statistically significant in both groups. Incidence of postoperative nausea and vomiting was also similar in both the groups. Side effect like respiratory depression not observed in either group. In conclusion, Intravenous infusion of dexmedetomidine added to subarachnoid block with bupivacaine offered prolonged analgesia in adult patients undergoing herniorrhaphies, without increasing the incidence of adverse effects.

KEYWORDS: Dexmedetomidine; Bupivacaine; Subarachnoid block.

INTRODUCTION: Central neuraxial blocks with local anaesthetics are popular techniques of anaesthesia which have been extensively used for lower abdominal surgery. Subarachnoid block is a

simple technique which requires a small dose of local anaesthetic to provide rapid and reliable surgical anaesthesia and minimal risk of drug toxicity.

Lignocaine provides rapid onset of action and good motor block manifested as good muscle relaxation, but its use is limited by the short duration of action and reports of lignocaine induced transient neurological symptoms or transient radicular irritation.[1] Bupivacaine has been used since 1963 and is now the most widely used local anaesthetic. Hyperbaric 0.5% Bupivacaine is a popularly used local anaesthetic drug for subarachnoid block. It is more potent and has a longer duration of action than lignocaine.

Duration of spinal anaesthesia may be prolonged by addition of opioids, clonidine, neostigmine, or vasoconstrictor agents to the local anesthetic drug for better postop pain relief. Intrathecal and epidural opioids provide selective analgesia without motor or sensory blockade. But they produce significant side effects like delayed respiratory depression, vomiting, pruritus and urinary retention.[2,3]

Intrathecal addition of a low dose of α2-agonist like clonidine or dexmedetomidine results in significant prolongation of the duration of the sensory and motor blockade induced by hyperbaric bupivacaine (Kanazi et al).[4]

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.

AIMS AND OBJECTIVES: To determine effect of intravenous Dexmedetomidine on the duration of analgesia with spinal Bupivacaine for adult patients undergoing herniorrhaphy and to assess the incidence of intra operative side effects, if any.

MATERIALS AND METHODS: This study was done under the department of Anesthesiology, Azeezia Medical College from March 2013 to October 2013.

Inclusion Criteria:

1. Patients of ASA grade I and II undergoing herniorrhaphies.
2. Age group 20- 60 yrs.
3. Weight between 65-75 kg.
4. Height >155cm and <175cm.
5. Either sex.

Exclusion Criteria:

1. Patient refusal to regional blockade.
2. History of drug allergy.
3. Patients with coagulation disorders.
4. Patient with liver disease, kidney disease, neurologic disorders, cardio vascular disease.
5. Infection at the site of injection.
6. Pregnancy.
7. Mentally retarded/psychiatrically ill patients.

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Design of Study: A double blind prospective randomized control study was done. Patients were allocated in to two study groups, named A and B using computer generated randomization.

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.

RESULTS: Data were analyzed using computer software, Statistical Package for Social Sciences (SPSS) version 10. Data are 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 (χ^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.

Age group >50 years dominated in both the groups and age group <40yrs represented only less than 12% of the population. Gender distribution in the study population showed male dominance in two groups with 92% in group A and 96% in group B. Female patients were only 8% in group A and 4% in group B.

The mean ages in both the groups were comparable and group A registered 51.36 years where as in group B, mean age was 50.96 years. Mean body weight in group A was 68.12 kg and in group B 68.4 kg.

Mean duration of surgery in group A was 54.4 minutes and in group B 55 minutes. In order to find out the equality of mean age, mean weight and mean duration of surgery Student's't' test was applied and it was found not significant for all the three parameters.

Mean time of onset of sensory blockade in group A is 3.48 mt and in group B is 3.48

Mean systolic blood pressure (SBP) in group A is 108 mmHg and for group B it is 112.56 mmHg. Mean heart rate in group A is 70.40/mt and for group B it is 74.24/mt. It is not statistically significant with p value> 0.05.

Mean time of onset of sensory blockade in group A is 3.48 mt and in group B is 3.48. It is not statistically significant with p value >0.05. [Fig.1]

Mean time to achieve maximum sensory blockade in group A is 11.96 mt and in group B is 11.52mts. It is not statistically significant with p value >0.05.

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Mean Time of first Analgesia is compared in two groups. Time of first analgesia in group A is 352.4 mts and for group B IS 184.28mts.It is statistically significant with p value<0.001. [Fig. 2]

Post-operative pain was evaluated by Visual Analogue Scale. In this scale 0 corresponds to no pain and 100 correspond to the worst pain possible. 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 3.2, 17.2, 26.4, 32.17, 39.09 and for group B is 10, 38.4, 48.57, 50.At 60 minutes the mean pain score for group A was 3.2 and for group B was 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 32.17. At 60mt, 2hr, 3hr, 4hr, 5hr, 6hr, 7hr, 8hr mean pain score in group A is increased from 3.2, 17.2, 26.4, 32.17, 39.09, 45, 48.57, 50.[Fig.3]

This 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, than the other group.

DISCUSSION: Inadequate treatment for pain can result in short and long term morbidity. So the provision of post-operative analgesia is mandatory during the administration of any analgesia. In this study, in lumbar subarachnoid block using heavy bupivacaine; saline and intravenous infusion of dexmedetomidine were compared for providing analgesia.

Dexmedetomidine, an α2 agonist, is pharmacologically related to clonidine, has 8 times more affinity for α2 receptors than does clonidine. It produces analgesia by binding to adrenoreceptors in the spinal cord. The analgesic effects of α2-adrenergic agonists could be mediated through supraspinal, spinal, and peripheral actions. It produces sedation and anxiolysis by binding to α2 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 thelocus 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.[5,6,7]

It has been used as adjuvant to local anesthesia in the intrathecal route and has significant effect on onset and duration of spinal anesthesia. 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.[8]

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.

Al-Mustafa MM et al, in 2011 conducted a study in 48 patients. 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.[9]

In this study mean pain score at 30 mt in group A is 0 and for group B is 0.4.It is not statistically significant. whereas mean pain score at 60mt, 2hr, 3hr, 4hr, 5hr in group A is 3.2, 17.2, 26.4, 32.17, 39.09 and for group B is 10, 38.4, 48.57, 50. Pain score at these interval is clinically and statistically significant with p value <0.001.

In this study mean time of onset of sensory blockade, mean time to achieve maximum sensory blockade in group A is 3.48 mt, 11.96 mt respectively and in group B it is 3.48, 11.52mts. It is not statistically significant with p value >0.05.

Incidence of hypotension after spinal anaesthesia has been reported to be 30-40 % due to sympathetic blockade. Previous study shown that hypotension present during intra-operatively as well as post operatively. In this study mean systolic blood pressure (SBP) in group A is 108 mmHg and for group B it is 112.56 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 10-15 %.In this study mean heart rate in group A is 70.40/mt and for group B it is 74.24/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 2-18 %. In this study incidence is 4% in group A and also 4% 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 offered prolonged analgesia in adult patients undergoing herniorrhaphies, without increasing the incidence of adverse effects.

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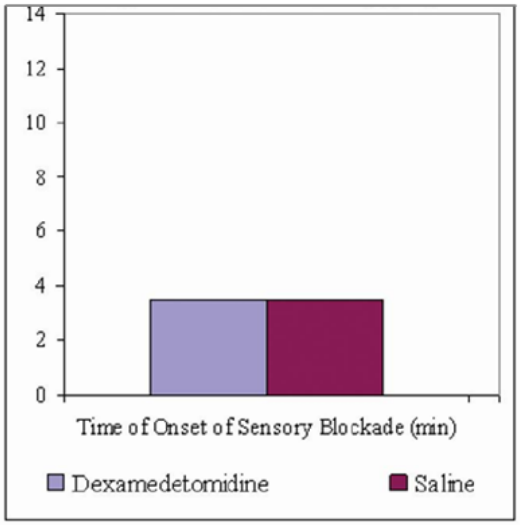

Fig. 1: Comparison of Time of Onset of Sensory Blockade (min)

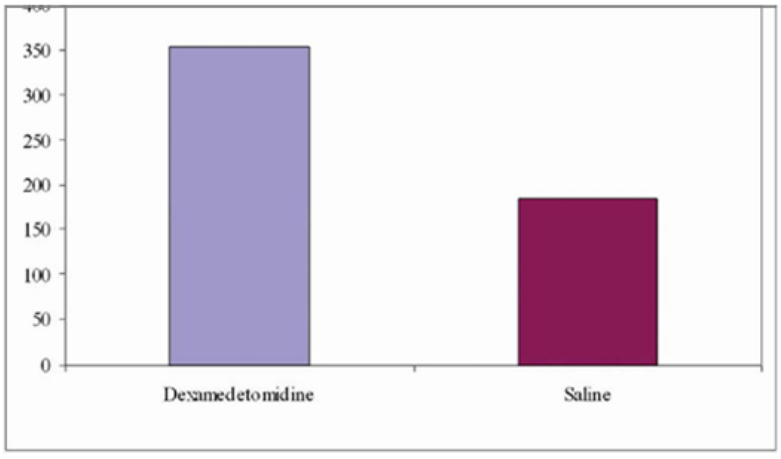

Fig. 2: Mean time of first analgesia in two groups (min)

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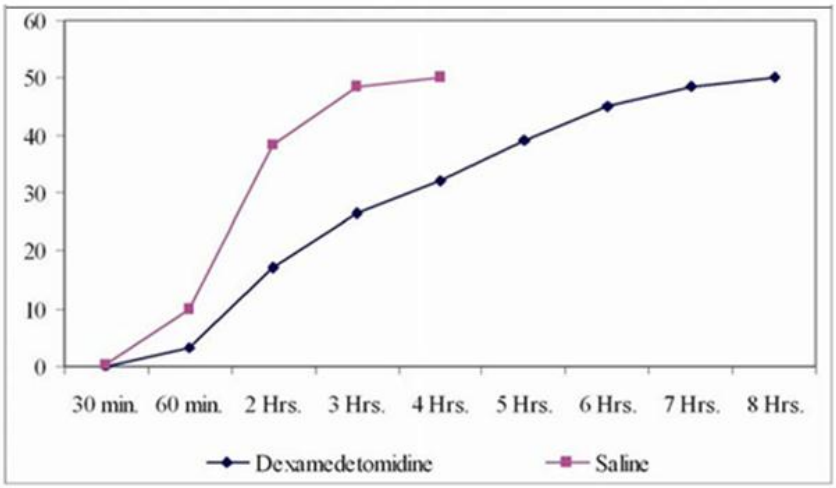

Fig. 3: Comparison of mean pain score between the two study groups

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