EFFECTS OF INTRATHECAL DEXMEDETOMIDINE ON BUPIVACAINE SPINAL ANESTHESIA IN PATIENTS UNDERGOING LOWER LIMB SURGERY
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ABSTRACT: Spinal anaesthesia is the most commonly used technique for lower limb orthopaedic surgery. Various drugs are being used as additive along with local anaesthetics agents in spinal anaesthesia for prolongation of intraoperative and post-operative analgesia. Dexmedetomidine is a highly selective alfa-2 adrenergic receptors agonist act on the dorsal horn of the spinal cord to prolonged the analgesic effects. AIM: Evaluate the effects of addition of 10μg of dexmedetomidine, to 2.5ml of 0.5% hyperbaric bupivacaine for spinal anaesthesia in lower limb orthopaedic surgeries. SETTING AND DESIGN: prospective, randomized, double blind study. METHODS AND MATERIAL: A study was carried out in 60 adult patients age between 20 and 60 years of age ASA grade I and II, scheduled for lower limb surgery under spinal anaesthesia. Patients were divided into 2 groups. Group DM received 2.5ml 0.5% hyperbaric bupivacain along with 10μg dexmedetomidine in 0.5ml of normal saline and Group NS received 0.5% hyperbaric bupivacaine along with 0.5ml of normal saline intrathecally. The parameters assessed were the onset time, time to reach peak sensory level and regression time of sensory block, rescue analgesia, hemodynamic changes and side effects were recorded. Statistical analysis was done using appropriate tests. RESULT: Patients in dexmedetomidine group (Group DM) had a significantly longer sensory block than patients in bupivacaine group (Group NS). The mean time of sensory regression to S2 was (323±31 min) in group DM and (191±15min) in group NS. The time to rescue analgesia was significantly longer in group DM (383±38 min) as compared to group NS (228.6±15 min). CONCLUSIONS: The addition of dexmedetomidine to bupivacaine intrathecally produces a prolongation of sensory block duration and analgesic period. KEYWORDS: Dexmedetomidine, Intrathecal, Postoperative analgesia.

INTRODUCTION: Spinal anaesthesia is the most commonly used regional anaesthetic technique for lower limb surgery. Spinal anesthesia has the advantage that profound nerve block can be produced in a large part of the body by the relatively simple injection of a small amount of local anesthetic. Intrathecal local anesthetics have limited duration. Different additives such as clonidine, fentanyl have been used to prolong spinal anesthesia.¹,² Dexmedetomidine, a highly selective α2 adrenergic agonist, as an adjuvant to hyperbaric bupivacaine in spinal anaesthesia provides good quality of intraoperative and prolonged post-operative analgesia with minimal side effects.³,⁴,⁵
SUBJECTS AND METHODS: Following approval of the institutional ethics committee, a study was carried out in 60 adult patient's age between 20 and 60 years of age ASA grade I and II, scheduled for lower limb surgery under spinal anaesthesia included. A written and informed consent was obtained from all patients. Exclusion criteria were patient having contraindications to spinal anesthesia, allergy to study drugs, pregnancy, diabetes and hypertensive patient. All patients received a tablet of alprazolam 0.25 mg and tablet ranitidine 150 mg orally night before surgery. In the operative room standard intraoperative monitors, like ECG, pulse oximeter, non-invasive blood pressure, were attached to patient and baseline parameter was recorded. The patients were preloaded with Lactate Ringer's solution 10 ml/kg. Using a random number sequence, Patients were divided into 2 groups. Group DM received 2.5 ml 0.5% hyperbaric bupivacaine along with 10μg dexmedetomidine in 0.5 ml of normal saline and Group NS received 0.5% hyperbaric bupivacaine along with 0.5 ml of normal saline intrathecally. The total volume of drug solutions was 3.0mL. An independent anaesthesiologist prepared the drug solutions before the start of the anesthesia. The anesthesia provider and patients were blind to study drugs.

A 23 gauge pencil point Spinal needles were used. Under all aseptic precautions spinal anaesthesia is given at L3-4 or L4-5 interspace in sitting position. After confirmation of free flow and clear cerebrospinal fluid, the drug was administered and patients immediately placed in the supine position. Oxygen 2l/min were given through a nasal pronge. Hypotension defined as a decrease in systolic blood pressure by more than 30% from baseline or less than 80 mm Hg was treated with incremental doses of mephenetermine 6mg intravenously and further boluses of IV fluid. Bradycardia defined as heart rate (HR) less than 50 bpm was treated with IV atropine 0.6 mg. The incidence of adverse effects such as nausea, vomiting, shivering, itching, pruritus, respiratory depression, sedation and hypotension was recorded.

Sensory block was assessed by using pinprick test. The time of onset of sensory block, highest level of sensory block and duration of sensory block were recorded. The onset of sensory block was defined as the time between injection of drug and the absence of pain at T10 dermatome. On achieving T8 sensory blockade surgery was allowed. Dermatomal levels were tested every 2 minutes until the highest level had stabilized for four consecutive tests. Testing was then conducted every 10 minutes until the two segment regression of the block occur. Further testing was performed at 20 minutes intervals until the recovery of S2 dermatome which was considered as duration of sensory block. Sedation was also assessed on a four point scale: 0 = fully awake, 1 = slightly drowsy, 2 = sleeping but easily arousable and 3 = unconscious, unarousable as described by Ng KF and colleague. Postoperatively, pain scores were recorded by using VAS between 0 and 10 (0 = no pain, 10 = the most severe pain), initially every 1 hour for 2 hours, then every 2 hours for next 8 hours and then after every 4 hours till 24 hours. Duration of analgesia was recorded when VAS score was >4 and patient received Injection diclofenac sodium 75 mg intramuscular as rescue analgesic.

Categorical variables like ASA status, sex, postoperative analgesic requirement and adverse effects have been compared between groups by using Chi square test. Parametric data were reported as mean±standard deviation and analyzed by using student t-test. The comparison was studied using chi-squared test or the Fisher's exact test as appropriate. P<0.05 was considered statistically significant.
RESULTS: The age, body weight, sex distribution, ASA status and duration of surgery was comparable in both the groups.[Table-1]. There was no difference in the onset time of sensory block up to T10 dermatome in both the groups. It was 3.53±1.1 in group DM and 3.60±1.2 min in group NS. There was no difference between group DM and NS in the highest level of block achieved (T5 and T6, respectively) and in the time taken to reach highest level (11.2±1.62 and 11.4±1.48 minutes, respectively).

Two segment block regression was significantly slower with the addition of intrathecal dexmedetomidine (121.33±16.5 min.) as compared with group NS (86.24±9.2min.) (P<0.001) and time to S2 segment regression were significantly slower with intrathecal dexmedetomidine (P<0.001).

The mean time from subarachnoid block to first request for pain medication i.e. the duration of analgesia was 376.37±20.60 min in the (10µg) dexmedetomidine group and it was 210.8±16.83 min in the NS group. This difference was also statistically significant (p<0.001).

Two patients in the DM group and three patients in the NS group complained of postdural puncture headache which was treated by hydration and simple analgesic medication. Other side effect such as bradycardia, nausea, and vomiting were not significant between the two groups and there was no neurological deficit observed in any patients. [Table 3]

| Variable            | Group DM     | Group NS     | P Value |
|---------------------|--------------|--------------|---------|
| Age (Yrs.)          | 41.27±5.64   | 40.4±4.74    | 0.52    |
| Sex(M/F)            | 18:12        | 22:08        | 0.273   |
| Wt.mean             | 54.13±7.24   | 52.83±6.8    | 0.476   |
| Mean Duration of Surgery | 80.75±10.49 | 81.88±11.12  | >0.05   |
| ASA status 1/2      | 16/14        | 17/13        | >0.05   |

Table:1 Demographic data

| Variable                          | Group DM     | Group NS     | P Value  |
|-----------------------------------|--------------|--------------|----------|
| Onset of sensory block (Min)      | 3.53±1.1     | 3.60±1.2     | >0.05    |
| Time to highest sensory level(Min)| 11.2±1.62    | 11.4±1.48    | >0.05    |
| Time for two segment regression (Min) | 121.33±16.5 | 86.24±9.2   | <.001    |
| Duration of sensory block(Min)    | 336.17±40.81 | 202±30.11    | <.001    |
| Time to first rescue analgesic(Min)| 376.37±20.60 | 210.8±16.83  | <.001    |

Table 2: Summary of Result

| Variable  | Group DM | Group NS | P Value |
|-----------|----------|----------|---------|
| Sedation  | 0        | 0        | >0.05   |
| Nausea    | 1        | 2        | >0.05   |
| Vomiting  | 2        | 3        | >0.05   |
| Hypotension | 7      | 6        | >0.05   |
| PDPH      | 2        | 3        | >0.05   |

Table 3: Side effects in two group
DISCUSSION: Dexmedetomidine is an S-enantiomer of medetomidine with a higher specificity for α2-adrenoreceptor (α2: α1, 1620: 1) compared to clonidine (α2: α1, 220: 1). It was first introduced into practical use as intravenous sedative after the approval of U.S. Food and Drug Administration in 1999. Since then it has been investigated as the anxiolytic, sympatholytic, and analgesic properties related to α2-adrenoceptor binding, and it is now being used as a co analgesic drug. Dexmedetomidine has been used for premeditation and as an adjunct to general anaesthesia. It reduces opioid and inhalational anaesthetics requirements. Intrathecal α2-receptor agonists are found to have antinociceptive action for both somatic and visceral pain.[8,9,10]

Kanazi GE in their study found that intrathecal small dose of dexmedetomidine (3μg) when used with bupivacaine in human beings for spinal anaesthesia produces a shorter onset of
motor block and a prolongation in the duration of motor and sensory block with stable haemodynamic and lack of sedation.\(^{(11)}\)

Rajni Gupta et al observed the effect of adding dexmedetomidine and fentanyl to intrathecal bupivacaine and reported that dexmedetomidine produces more prolonged motor and sensory block as compared to fentanyl.\(^{(12)}\) In an another study Rajni Gupta et al noticed the effect of adding 5 µg dexmedetomidine to ropivacaine and concluded that 5µg dexmedetomidine seems to be an attractive alternative, as an adjuvant to spinal Ropivacaine, for surgical procedures requiring long time. It has excellent quality of postoperative analgesia with minimal side effects.\(^{(13)}\)

Al- Ghanem in their study suggested that 5 µg dexmedetomidine seems to be alternative as adjuvant to spinal bupivacaine in surgical procedures, especially in those who need quite long time with minimal side effects and excellent quality of analgesia.\(^{(14)}\)

Halder S. in a double-blind, randomize study evaluated the effect of different doses of Dexmedetomidine as adjuvant to Bupivacaine in Subarachnoid block for traumatized lower limb orthopedic surgery and concluded that addition of 10 µg in comparison to 5 µg dexmedetomidine to 0.5% hyperbaric bupivacaine more efficiently hastens the onset and prolongs the duration of sensory and motor blockade and reduces the requirement of rescue analgesic in postoperative period for the patients undergoing traumatized lower limb orthopaedic surgery.\(^{(15)}\)

In our study, we found that the addition of 10 µg of intrathecal dexmedetomidine prolonged the sensory block effect of bupivacaine by approximately 6 hours and the post-operative analgesic effect of intrathecal bupivacaine was potentiated by intrathecal dexmedetomidine. In addition, dexmedetomidine-treated group required less postoperative analgesic in the first 24 hours after surgery.

**CONCLUSION:** In conclusion, our study showed the Effects of 10µg of Intrathecal dexmedetomidine, on Bupivacaine Spinal Anesthesia, produces earlier onset and prolonged duration of sensory block without significant side effect in Patients Undergoing lower limb surgery and provides excellent quality of post-operative analgesia.

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