Original Article

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Comparative Study between Intrathecal Bupivacaine and Intrathecal Bupivacaine with Dexmedetomidine as an Adjuvant

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Abstract

Background: Dexmedetomidine is an α_2 adrenergic agonist is used as adjuvant to local anesthetics intrathecally. It produces satisfactory effect with quite lower doses of spinal bupivacaine. Present study was done to assess the effect of intrathecal Dexmeditomidine added to Bupivacaine on onset and duration of sensory and motor block and post operative analgesic effect. **Subjects and Methods:** This was a prospective, observational study in 60 selected patients who were posted for lower abdominal surgeries were divided in to two groups by simple random sampling. One group received only Bupivacaine while the other group received Bupivacaine and Dexmedetomidine. Effects of Spinal Anaesthesia, haemodynamics as well as their side effects were studied. The quantitative variables were compared using two-tailed student's t-test assuming equal variance for both the study groups. **Results:** The density of both motor and sensory blockade was increased up to 3 to 4 hours postoperative, after adding dexemedetomidine. Addition of Dexmedetomidine bupivacaine intrathecally improves the postoperative analgesic efficacy. The mean analgesic requirement was lower for patients in whom intrathecal Dexmedetomidine to bupivacaine did not produce any untoward intraoperative and postoperative complications. **Conclusion:** Dexmedetomidine with bupivacaine produces satisfactory anesthesia without hemodynamic instability.

Keywords: Adjuvant, dexmedetomidine, bupivacaine, abdominal, spinal anesthesia.

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Introduction

Spinal anaesthesia is the commonest anaesthetic technique for lower abdomen and lower limb surgery. It is easy to perform and provide fast onset and effective motor and sensory block. Local anaesthetics have been traditionally used for instituting subarachnoid block. A number of opioids and non-opioid substances like, clonidine, midazolam, ketamine and neostigmine have been given intrathecally in an attempt to interrupt the spinal pain pathways at other receptors, hence increasing the duration of post-operative analgesia optimizing the patient safety and comfort.[1]

Local anesthetics are the commonest agents used for this purpose, but they have a short duration of action. α_2 agonists such as clonidine, dexmedetomidine (DXM) have been used neuraxially as local anesthetic adjuvant to enhance perioperative analgesia.

Subarachnoid administration of clonidine has been shown to significantly increase the duration of anesthesia produced by isobaric or hyperbaric bupivacaine with good safety profile.[2-4] DXM (Dexmedetomidine), a highly selective α2 agonist drug, is approved by FDA as an intravenous sedative and co-analgesic drug. Its use is often associated with a decrease in heart rate and blood pressure. Intrathecal and epidural characteristics of DXM have been studied in animals. Dexmedetomidine has been recently evaluated as an adjuvant to intrathecal local anesthesia.[5-7] Dexmedetomidine prolongs the duration of intrathecally administered local anesthetics and has potent antinociceptive properties.[8] Although such prolongation of the effects of local anesthetics has been reported for intravenous.[9] DXM administration, the intrathecal route is more effective in prolonging bupivacaine spinal anesthesia.

Present study was done with an objective to assess the effect of intrathecal Dexmeditomidine added to Bupivacaine on onset and duration of sensory and motor block.[2] To assess the effect of intrathecal Dexmeditomidine added to Bupivacaine on the patient's haemodynamics.[3] To assess the effect of dexmeditomidine on duration of postoperative analgesia.[4] To assess the side effects/adverse effects of Dexmeditomidine when added to Bupivacaine spinal anaesthesia

Subjects and Methods

This study was prospective observational conducted at Sterling Hospital, Ahmedabad. Approval of Institutional Ethical Committee and Written Informed Consent from all patients had been obtained. 60 selected patients during the period of January 2016 to August 2018, who were posted for lower abdominal surgeries were divided in to two groups by

simple random sampling without replacement by lottery method. Each group had 30 patients each. Group B acted as Control group (Bupivacaine only) while Group D: Dexmedetomidine group (Bupivacaine + dexmedetomidine) acted as Study group. Selection criteria were patients aged between 18-75 Years, of either gender with American Society of Anaesthesiology (ASA) grade I and II. Patients who were excluded were the ones who refused, Body weight of more than 100kg, Height less than 150cms, Uncontrolled systematic diseases, Allergic to drugs, patients using alpha 2 adrenergic receptor antagonists, calcium channel blockers, angiotensin converting enzyme inhibitors, drug or alcohol abusers. Routine investigations in the form of Complete blood count, blood sugar, urea, serum creatinine, coagulation profile, Rh typing, X ray chest, ECG, SGPT was carried out. The patients who were posted for lower abdominal surgeries were scrutinized as per criteria mentioned above. They were randomly divided in to control and study group. All the patients were fasted overnight for 8 to 10 hours. No intravenous fluid was given till arrival to operating theatre. Patient will receive no premedication before arrival in the operation theatre. Psychological preparation was done and procedure was explained to all the patients in advance. On arrival in the operating room an IV access was secured using an 18G/20G cannula in the forearm vein. Before spinal block, each patient was preloaded with 8 to 10 ml/kg of Ringer lactate normal saline solution. Standard monitoring including continuous ECG, pulse oximeter, non invasive automated blood pressure measurements and visual assessment of respiration was done and baseline values was noted.

In all patients under strict aseptic precautions, lumber puncture was performed in left lateral position or sitting position after giving local anaesthesia with 24G hypodermic needle using a 23G Quinckes' point spinal needle, positioned midline at L3-L4 interspace after free flow CSF is obtained study drug was injected. OT table was having 5 degree head low tilt. Group B patients will receive hyperbaric 0.5% bupivacaine 18mg (3.6ml), Group D patients will receive hyperbaric 0.5% bupivacaine 18mg (3.6ml) + 5 µg dexmedetomidine (0.05ml). After completion of injection patients was immediately returned to the supine position.

The onset of sensory blockade was assessed by pinprick method. A sensory level of T6 was considered adequate to allow surgery to proceed. Time to onset of T6 sensory level was recorded. Time to regression of sensory from T6 to L1 was checked by pinprick method and recorded, which was considered as the duration of sensory blockade. Recording of heart rate, blood pressure, O_2 saturation and respiratory rate was done every 5 min for 15mins, than every 15 mins for next 45 mins, every 1 hr for next 7 hrs, than 4 hrs for next 16 hrs. Throughout the procedure patient will receive an O_2 supplementation of 4 lit/min via O_2 mask. The time to onset of complete motor blockade was recorded as the time to achieve Modified Bromage scale 3. The duration of motor blockade was the time to achieve Modified Bromage scale 0.

Episode of perioperative hypotension (defined as systolic BP <90 mm Hg or >25 % fall of pre induction BP) was treated with fast infusion of intravenous fluids and /or Inj. Mephentermine 6 mg I.V. in incremental doses. Bradycardia (defined as heart rate < 50 bpm) was treated with Inj. Atropine 0.6 mg I.V. Patient was monitored for respiratory depression and will managed with 100% O_2. Perioperative degree of sedation was assessed by using Campbell sedation score starting 30 min from subarachnoid drug injection of drugs till 12 hrs post operatively. Perioperative emetic response was recorded. Inj. Ondansetron 0.15 mg/kg I.V. was given as rescue antiemetic. Pruritus was treated with Inj. Diphenhydramine 25mg I.V. Post-operative pain was assessed every 15min using visual analog score (VAS: 0-10). Time to first analgesic request was noted. Patients were given Inj. Diclofenac 1.5 mg/kg I.V. as a rescue drug when VAS more than 3/10 was recorded.

In addition to the loading dose of I.V. fluid, patients will receive a maintenance infusion of Lactate Ringer solution as calculated according the conventional formula. Intra op blood loss was replaced as indicated. No additional sedative medications were given during the operation. The protocol was allowed for conversion to general anaesthesia for inadequate anaesthesia (patients complain of pain) as deemed necessary by the blinded anaesthesiologist.

Statistical Analysis

The Statistical analysis was done using Statistical analysis was performed with Statistical analysis was performed with Software Epi Info 7.0 Data Entry: Student's t-test. For tables, graphs, student T test the main tools of analysis. Data was expressed as either mean and standard deviation or numbers and percentages. Both the study groups were compared using t-test. In case of rescue drugs student T test was used. 'P' value < 0.05 was considered as statistically significant.

Results

All the patients in both the groups were demographically comparable to each other [Table 1].

There was no statistically significant difference in pulse rate, systolic blood pressure, diastolic blood pressure, SpO_2 before subarachnoid block between the groups. There was no significant change between the two groups during the intra-op period in all the above parameters.

The mean duration of Sensory blockade in Group D was 458.9 ± 8.91 min and in Group B it was 184.91 ± 10.81 min.(p value is < 0.05). The mean duration of motor blockade in Group D was 410.41± 6.91 min and in Group B it was 158.8 ± 13.18min. (p value is < 0.05). The mean duration of onset of motor block to Bromage 3 in Group D was 11.61± 0.44 min and in Group B it was 9.22± 0.89min. (p value is <0.05). The mean duration of analgesia in Group D is 336.8± 18.33 min and in Group B was 171.61± 13.88min (p value is < 0.05). The mean visual analogue scale at 3thand4th hrs is significantly lower in Group D compare to Group B (p value is < 0.05). At the end of 5th hr, almost all patients in Group D required rescue analgesia. Whereas in group B, all patients required rescue analgesia by 3 hour. In Group D 8(26.6%) patients required rescue analgesics by 5hrs and 22 (73.3%) patients required rescue analgesic by 6 hrs while in Group B only 24(80%) patients required rescue analgesic by 3 hrs and 06 (20%) patients required rescue analgesic by 4 hrs. (p value < 0.05). By 5th hour only 26.6% patients in Group D had received rescue analgesic whereas in Group B all patients received rescue analgesic. This shows

that demand for rescue analgesics in Group B is earlier than in Group D. There was no significant difference in complications in both the groups. [Figure 1]

Table 1: Demographic Characteristics of Patients Among The Groups.

Variable	Group D	Group B	p value
Age (yrs)	64.14 ± 7.22	61.01±9.41	0.132
Sex (M/F)	14/16	13/17	--

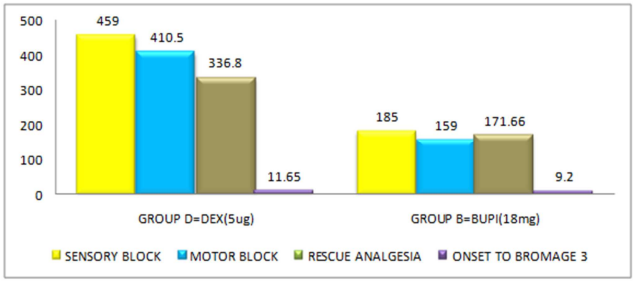

Figure 1: Comparison between two groups for duration of sensory block, Motor block, rescue analgesia and onset to Bromage 3.

Discussion

Pain is an inevitable consequence of surgery. The fight to over the misery of pain is the fundamental aim of all branches of medical science. With the advancement of anesthesia, intra operative care has been extended to post operative period for better pain management of patient. Postoperative pain is better managed with opioids & non-opioids drugs. The discovery of non-opioid receptors like alpha-2 receptors & the subsequent development of technique of epidural & intrathecal administration is one of the most significant advances in pain management in last three decades.

This study was undertaken with idea of providing effective and prolonged pain free recovery period in patient undergoing lower abdominal surgery with the purpose was to compare the intraoperative and post operative analgesic effect of of intrathecal dexmedetomidine 5 µg with bupivacaine 0.5%(H)(3ml) to minimize the postoperative side effects. The drug acts at spinal & supraspinal level.[10,11] As compared clonidine, it has 8-times affinity for α_2 receptors. Hence, when used as an adjuvant to local anesthetics, it leads to sensory and motor block for longer duration and reduces need for analgesic requirements.[12,13] Incidence of side effects like respirator depression are rarely seen.[14]

Dexmedetomidine significantly prolongs sensory and motor block and there is decreased postoperative analgesic requirement similar to clonidine and fentanyl.[15] 2.5 µg of Dexmedetomidine producesd similar effect of analgesia as 250 µg of morphine when added to 15 mg of hyperbaric bupivacaine.[16]

In a study by Anandani et al., comparison was done between bupivacaine with dexmedetomidine and bupivacaine with dexmedtomidine, for spinal anesthesia in 60 patients belonging to ASA Grade 1 and 2 undergoing elective gynecological surgery. The onset time to reach dermatome T4 and Modified Bromage 3 motor block were not significantly different between two groups. Dexmedetomidine group showed significantly less and delayed requirement of rescue analgesic. Intrathecal dexmedetomidine is associated with prolonged motor and sensory block, hemodynamic stability and reduced demand of rescue analgesic in 24 hrs as compared to clonidine.[17]

In a study by Sudheesh et al. intrathecal dexmedetomidine 3 µg dose did not produce faster ambulation compared to 5 µg dose in combination with 4 mg bupivacaine though it produced comparable duration of analgesia for perianal surgeries. The median block heights attained in the two groups were L1 and T11, respectively. In another study, dexmedetomidine 5 µg and fentanyl 25 µg was added to low dose of 4 mg bupivacaine for lower abdominal surgeries; however, they were able to achieve the desired level only by a 5°–10° Trendelenburg position. Hence, we did not choose too low a dose of bupivacaine. In our study, we used a dose of dexmedetomidine that would produce minimal hemodynamic side effects.

Conclusion

Our study has demonstrated that addition of concentration of DXM (5ug) to bupivacaine in the dose of 5µg produce significantly increase in the duration of analgesia, motor and sensory block in dose without significant side effects. The most significant side effects reported about the use of intrathecal alpha-2 adrenoreceptor agonists are bradycardia and hypotension. In our study, these side effects were not significant probably because we used small dose of intrathecal DXM.

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