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Effect of different doses of IV dexmedetomidine on spinal anesthesia with hyperbaric bupivacaine in Trans urethral resection of prostate surgery

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Abstract

Aim:Aim of this study was to compare the characteristics of spinal block, hemodynamic changes, and postoperative analgesia, following administration of intravenous dexmedetomidine (0.25 mcg/kg and 0.5 mcg/kg) in patients undergoing TURP under spinal anaesthesia.

Methods:90 patients of ASA grade I and II posted for elective transurethral resection of prostate surgeries were included in the study and randomly allocated into three groups. All three groups received 3ml of intrathecal 0.5% bupivacaine heavy, followed by infusion of study drug.Group D5 received intravenous dexmedetomidine 0.5mcg/kg over 10 min,Group D2 intravenous dexmedetomidine 0.25mcg/kg over 10 min and Group NS received infusion of same volume of normal saline as placebo.Duration of analgesia,time to 1st analgesia request,VAS score,hemodynamics and side effects were recorded and analyzed.

Results:The prolongation in duration of analgesia in D5 group was statistically significant in comparison to other groups. Time to 1st analgesia request was delayed in group D5 compared to other groups which was statistically significant. Hemodynamic stability was well maintained in both dexmedetomidine group.

Conclusion:Intravenous dexmedetomidine not only increased the duration of spinal analgesia but also maintained hemodynamic stability. IV Dexmedetomidine in a dose of 0.5 mcg/kg was more effective than 0.25 mcg/kg without increasing the risk of adverse effect.

Key words: Dexmedetomidine, spinal anaesthesia, hyperbaric bupivacaine, TURP

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Introduction

Most of the patients posted for trans urethral resection of prostate (TURP) surgery are operated under spinal anaesthesia.Spinal anaesthesia is distinguished by its ease to performance with a definite end point, rapid onset of action, excellent anaesthetic efficacy and motor blockade.[1]Spinal anaesthesia is a well-known technique used in lower abdominal, urological, and lower extremity procedures and a variety of agents like epinephrine, phenylephrine, adenosine, magnesium sulfate and clonidine, have been used as adjuncts to local anesthesia for prolonging the duration of spinal anaesthesia.[2] The addition of adjuvants to local anesthetics gained an extensive reputation due to the belief that they might prolong spinal anaesthesia, decrease the dosage of local anaesthetic, delayed-onset of postoperative pain and reduced analgesic requirements.Dexmedetomidine is a highly selective α2-adrenoreceptor agonist.[3] It has been used for premedication and as an adjunct to general anaesthesia, as it provides preoperative sedation, analgesia and hemodynamic stability and reduces requirements for intraoperative inhalational agents and prolongs postoperative analgesics.[4]Also, it has been used safely as premedication or as a sedative agent in patients undergoing surgical procedures under regional anaesthesia.[5] Although a synergistic interaction between intrathecal dexmedetomidine and local anaesthetics has been observed in previous studies,there are few clinical data regarding the effect and proper doses of intravenous dexmedetomidine premedication on the duration of sensory and motor block during spinal anaesthesia.[6]Hence this study was done to assess the effects of different doses of intravenous dexmedetomidine premedication on spinal block characteristics in patients undergoing TURP surgeries.

Methods

90 patients undergoing TURP under spinal anaesthesia in a tertiary care Hospital were included in the study during the period June 2023 to May 2024. The study was approved by Hospital Ethical Committee. Patients were allocated into one of the three groups, 30 patients each, based on a computer generated random numbers table:

- GroupD5: Dexmedetomidine group- 0.5 mcg/kg
- Group D2: Dexmedetomidine group-0.25 mcg/kg
- GroupNS: Normal saline group

Exclusion criteria:

ISSN:0975 -3583,0976-2833 VOL 15, ISSUE 07, 2024

- Patient refusal
- Coagulopathy
- Hemodynamically unstable patients
- Allergy to any of the study drugs

After intravenous insertion of an 18-G catheter in the operating room, all patients received 500 ml of lactated Ringer's solution as preloading before spinal anaesthesia. Monitors included electrocardiography, non-invasive blood pressure measurement, pulse oximetry to measure oxygen saturation (SpO2). All the patient were placed in the sitting position and dural puncture was performed at the L3-4 interspace using a standard midline approach with a 25-G Quincke needle. Bupivacaine 0.5% 3 ml was injected intrathecally, and all the patients received oxygen 4 L / min via a facemask throughout the procedure.IV infusion of dexmedetomidine started after a 1 μg/kg loading dose over 10 minutes, followed by a continuous infusion 0.5 μg/kg/hr in group D5, 0.25 μg/kg/hr in group D2. Saline infusion were given IV in group NS.Both the patient and the anaesthesiologist was blinded to the treatment group, and all recordings was performed by an anaesthesiologist blinded to group allocation.Sensory blockade was assessed using pin prick in the mid-axillary line. Recovery time for sensory blockade was defined as two dermatome regression of anaesthesia from the maximum level.Motor block was assessed immediately after sensory block assessment using a Modified Bromage Scale :1= no paralysis; 2 = unable to raise extended leg;3 = unable to flex knee;4 = unable to flex ankle. Motor block duration was measured as the time for return to Modified Bromage Scale 1.Sensory and motor block was assessed every 2 min for the first 10 min and thereafter every 10 min during surgery and postoperatively.The highest sensory block level and recovery time of both sensory and motor block was recorded. Postoperative pain was assessed using the visual analogue scale(VAS),0 = no pain; 10 = worst possible pain.In addition, the overall 24-hr pain VAS was evaluated by the overall pain impression of the patient for 24 hr postoperatively. Patients with a VAS score of 3 or more received IV tramadol100mg. The time for the first request for postoperative analgesia and the number of patients who required supplemental analgesia were recorded.The Ramsay sedation score was used for sedation score: 1 = anxious and agitated; 2 = cooperative and tranquil; 3 = drowsy but responsive to command; 4 =asleep but responsive to a glabellar tap; 5 = asleep with a sluggish response to tactile stimulation; 6 = asleep and no response. The score was re-evaluated every 10 min for up to 120 min. Excessive sedation was defined as a score greater than 4/6.Heart rate (HR), mean blood pressure (MAP), oxygen

ISSN:0975 -3583,0976-2833 VOL 15, ISSUE 07, 2024

saturation (SpO2), and respiratory rate (RR) was recorded before premedication, 2 min after end of premedication, immediately before and after dural puncture, and every 5 min for 120 min after spinal anaesthesia. Hypotension (defined by a decrease in MAP below 20% of baseline or systolic pressure < 90 mmHg) was treated with intravenous ephedrine 5 mg and additional lactated Ringer's solution (200 mL over a 5 min period).Bradycardia (HR-50 beats/min) was treated with intravenous atropine 0.6 mg. The occurrence of any complication in the preoperative and postoperative periods was noted, particularly in relation to respiratory or cardiovascular problems, nausea or vomiting, and headache. Statistical analysis: The data was analysed statistically using SPSS version 24 (SPSS Inc., Chicago, IL, USA). The ANOVA test was used to assess differences among the 3 groups with respect to non-parametric variables. A 'p' values <0.05 was considered to be statistically significant.

Results

90 ASA I & II patients, who had satisfied the criteria of inclusion and exclusion were included in the study. The written consent was taken from the patients. There was no statistical difference in three groups regarding demographic parameters.(table-1)

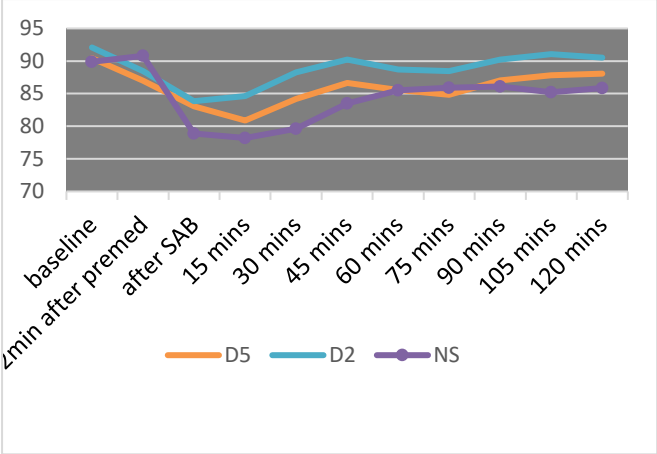
Table 1:Demographic parameters

Parameters	Group D5 (n=30) (mean ± sd)	Group D2 (n=30) (mean ± sd)	Group NS (n=30) (mean ± sd)	P-value
Age (yrs)	56.72±3.18	56.15±2.97	56.25±2.53	.362
Weight(kg)	74.9±9.4	76.8±5.24	77.8±9.4	.621
Height(cms)	161.6±5.85	165.2±6.15	163.6±5.9	.162

The mean and standard deviation of intraoperative mean arterial pressure among the three groups were compared. There is no statistical significance difference among 3 groups. The Mean arterial pressure between the three groups at 15,30,45, 90, 105, 120 minutes were compared by ANOVA yields P value of <0.05 ,but the pair wise significance analysis by BONFERONI test revealed no statistically significant result between D5 and D2 groups.(Fig 1)

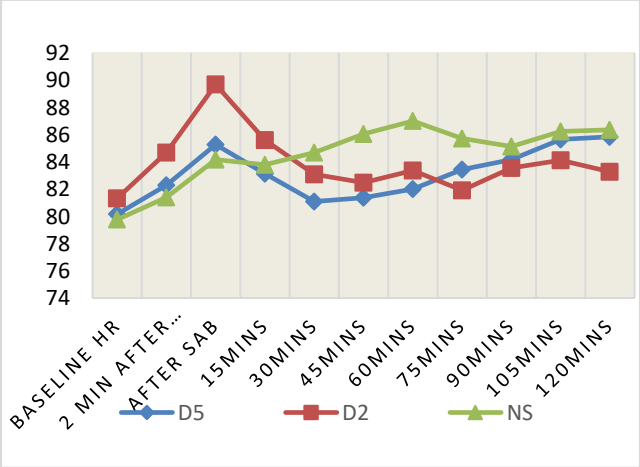
Figure 1:Changes in MAP

ISSN:0975 -3583,0976-2833 VOL 15, ISSUE 07, 2024



The mean and Standard deviation of intraoperative heart rate were compared among three groups D5, D2 and NS. The heart rate between the three groups at 5, 45, 120 mins were compared by ANOVA yields P value of <0.05, but the pair wise significance analysis by BONFERONI test revealed no statistically significant result between D5 and D2 groups.(Fig 2)

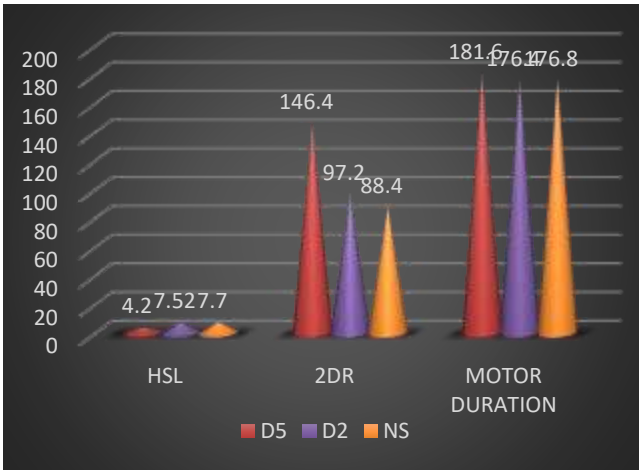
Figure 2: Changes in HR



The results displayed that there is a significant difference in time to reach highest sensory levels, two segment regression among the three groups. The pair wise comparison of groups showed that group D5 is significantly different from other two groups for two segment regression(DR) and Highest sensory level(HSL). The time taken for HSL in group D5 is lesser than group D2 and group NS. The time taken for 2 DR is more in group D5 in comparison to D2 and normal saline group. The motor block (Bromage 3 to Bromage 1) among the three groups are not statistically significant. (Fig 3)

Figure 3: Changes in HSL,2DR,Motor duration

ISSN:0975 -3583,0976-2833 VOL 15, ISSUE 07, 2024



ANOVA was done to determine whether there is a significant difference in the visual analogue scale and time for analgesia among the three groups D5, D2 and NS. The results obtained from the analysis shows that there is a significant difference with respect to VAS. It is lesser in D5 group compared to D2 and normal saline group ($p<0.05$).(Fig 4)

Figure 4: Changes in VAS

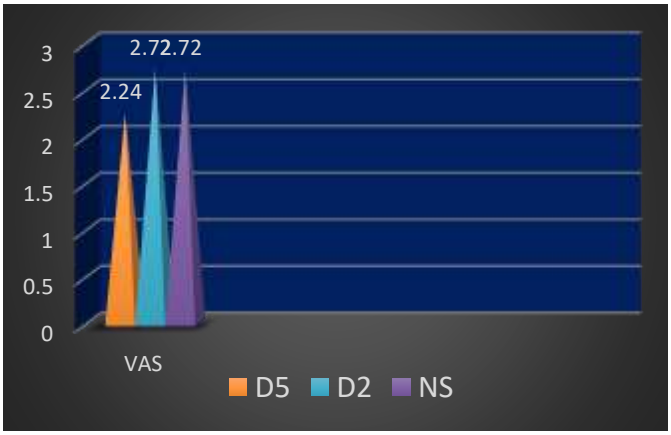
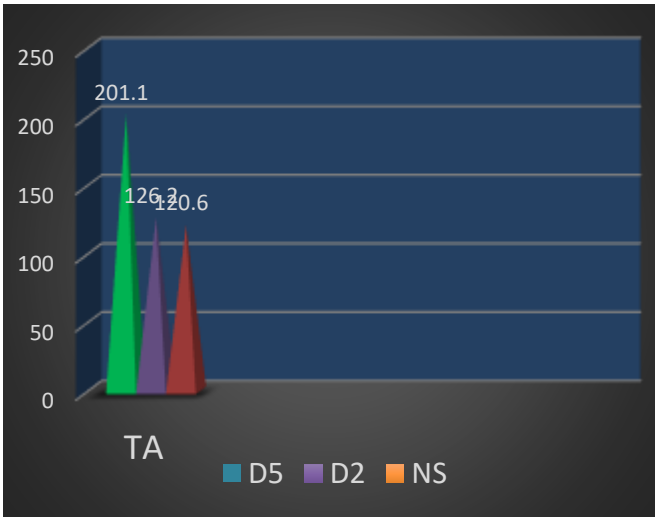


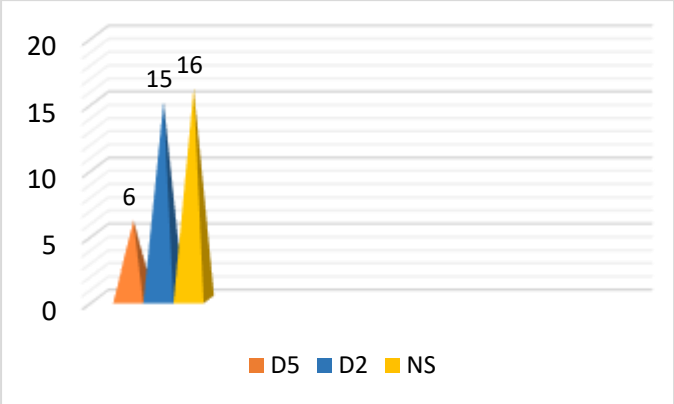
Figure 5: Time to rescue analgesia requirement

ISSN:0975 -3583,0976-2833 VOL 15, ISSUE 07, 2024



Time to first request for postoperative analgesia was later in the D5 group than in the D2 and normal saline groups (P<0.05). Fewer patients in the D5 group required rescue analgesic during the first 24hr after spinal block than in the D2 and saline groups (Fig 5,6).

Figure 6: No of patients requiring rescue analgesia.



Chi-square test analysed that there is no significant difference between the three groups in the occurrence of hypotension. Sedation was observed more in patients of the Dexmedetomidine group compared to NS group. Chi-square test determined that there is no significant difference between the three groups regarding the incidence of bradycardia dyspnoea, shivering and nausea.

Discussion

Adequate sedation in spinal anesthesia relieves the anxiety of the patient, improves physiological and psychological stress, and increases the satisfaction of both the surgeon and patient.[7] On the other hand excessive sedation not only masks the early signs of TURP syndrome but also produces postoperative delirium in elderly patients. So, the aim of

ISSN:0975 -3583,0976-2833 VOL 15, ISSUE 07, 2024

sedation with spinal anaesthesia in TURP should be to provide a cooperative and arousable patient with cardiopulmonary stability.[8] Dexmedetomidine is a sedative, hypnotic, analgesic, and to a certain extent can cover up inadequate block height and has minimal respiratory depressant effect.[9] α-2-adrenoceptor agonists are being commonly used for their sedative, analgesic, sympatholytic, anaesthetic-sparing and favourable haemodynamic properties. Dexmedetomidine, is an α agonist having a relatively high α_2/α_1-activity ratio (1620:1) as compared to clonidine (220:1). It has no respiratory depressant action, and provides conscious sedation making it therapeutically a useful and safe adjunct.[10]In the spinal cord, activation of both α_2 C and α_2-a adrenoceptors, located in superficial dorsal horn neurons especially the lamina II. Postsynaptic activation of central α_2 adrenoceptors, results in a fall in blood pressure and heart rate, which attenuate the surgical stress.[11]In our study, all three groups were comparable with respect to demographic profile, duration and type of surgery. Intravenous dexmedetomidine prolonged the motor and sensory block of bupivacaine. Intravenous dexmedetomidine acts by depressing the release of C-fibres transmitters through binding to presynaptic C fibres and by hyperpolarization of postsynaptic dorsal horn neurons.[12] In our study maximum sensory block was achieved significantly earlier in Group D5 and block persisted for longer duration in this group compared to D2 group. Two segment regression of sensory block was found earlier in D2 group as compared to D5 group and the difference was highly significant, which could be attributed to the lower doses of dexmedetomidine in D2 showing a positive additive or synergistic effect of higher doses of dexmedetomidine as seen in D5. Similar to our study Jung et al[13] had conducted a study where they compared two different doses of dexmedetomidine (0.25 and 0.5 mcg/kg) to control group and found that two dermatome sensory regression time was significantly increased in dexmedetomidine groups. The duration of motor and sensory anesthesia was significantly increased in group 0.5 mcg/kg. But maximum level of block was not found different in three groups. More et al [14]did not found any significant difference in time to achieve highest sensory block in dexmedetomidine group as compared to normal saline group but duration of sensory block and two segment regression of sensory block was significantly prolonged in dexmedetomidine group as compared to saline group which is in support of our study. Abdallah et al[15] in a systematic review and meta analysis found that IV dexmedetomidine can prolong the duration of sensory block by at least 34% and motor block duration was prolonged by at least 17%. In our study, there was significant reduction in the VAS scores and requirement of rescue analgesia in the postoperative period and delayed the requirement of 1st rescue analgesic request in the patients receiving IV

ISSN:0975 -3583,0976-2833 VOL 15, ISSUE 07, 2024

Dexmedetomidine(0.5 mcg/kg). This is in agreement with study by Gupta K.[16]Cardiovascular profile in our patients was stable in the intraoperative and postoperative period in dexmedetomidine group compared to other groups. Dinesh et al[17] also reported prolongation in time for request of first rescue analgesic and 24 hours mean analgesic requirement lesser in dexmedetomidine group compared to control group. Similarly Reddy et al[18] when compared intravenous dexmedetomidine with clonidine before spinal anesthesia, observed delayed first rescue analgesic request in iv dexmedetomidine group.

Conclusion

We concluded that 0.5 mcg/kg of IV dexmedetomidine provided better spinal block characteristics when compared to 0.25mcg/kg without any side effects in TURP surgery.

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ISSN:0975 -3583,0976-2833 VOL 15, ISSUE 07, 2024

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