ORIGINAL ARTICLE

EFFECTIVENESS OF INTRATHECAL DEXMEDETOMIDINE IN COMBINATION WITH HYPERBARIC BUPIVACAINE FOR LOWER ABDOMINAL SURGERIES AND ITS POSTOPERATIVE ANALGESIC CHARACTERISTIC

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Background: Intra-thecal anaesthesia is the commonly preferred, block for surgeries of lower abdomen, perineal and lower limb. It is easy to administer and very economical but needs skills. Intrathecal use of local anaesthetics possesses a short duration of action and needs early use of rescue analgesia postoperatively. Objective was to assess the efficacy of Dexmedetomidine in adjuvant with bupivacaine for neuraxial anaesthesia and postoperative analgesic characteristics. It was a prospective comparative study, conducted at Anaesthesia Department, Liaquat National Hospital, Karachi from January to July 2020. **Methods:** Overall 100 patients conveniently recruited who underwent lower abdominal procedures were allocated into two groups by randomization, i.e., 50 in each group and were labelled as Group N and Group D10. Group N consist of 0.5% bupivacaine 10 mg (2 ml) + diluted with 0.5ml normal saline dilution and group D10 consist of 10 µg Dexmedetomidine + 0.5% bupivacaine 10 mg (2 ml) with 0.5 ml normal saline dilution, total 2.5 ml dose in each group. The duration of block and regression was evaluated. **Results:** The study showed significant differences in sensory and motor block to reach T10 and Bromage 3 respectively. Patients who were assigned in Group D reported short onset of sensory to reach T10 (5.4±1.17) and motor to reach Bromage 3 (10.4±1.03) as compared to Group N (9.9±2.12 and 17±22) respectively. Participants of Group D required rescue analgesia in less amount throughout intervals as compare to group N. **Conclusion:** The usage of 10ug Dexmedetomidine adjuvant with 0.5% bupivacaine significantly reduced the onset on sensory T10 and motor Bromage 3 and also prolong duration of sensory and motor regression, moreover minimal adverse effects and less use of rescue analgesic drugs were observed.

Keywords: Bupivacaine; Dexmedetomidine; Motor Block; Motor Regression; Sensory Block; Sensory Regression

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INTRODUCTION

Intra-thecal anaesthesia is the commonly preferred, block for surgeries of lower abdomen, perineal and lower limb. It is easy to administer and very economical but needs skills. Intrathecal use of local anaesthetics possesses a short duration of action and needs early use of rescue analgesia postoperatively. Despite, there are many developments in postoperative pain management that have been taken placed, but still, it is difficult to provide an effective postoperative pain management with manageable side effects. Many adjuvants like fentanyl, morphine, ketamine, neostigmine, and clonidine are being used to prolong the analgesic effects of local anaesthetics for many years. These drugs including opioids are usually results in several side effects include itching, decrease respiration, difficulty in urination, postoperative gastrointestinal disturbance which can be overcome by preferring them as adjuvant with other analgesic[1,2] Using two or more drugs of different classes in a lower dose combination can decrease the incidence of adverse effects. For this reason, balanced analgesia has been used as a postoperative pain management in recent years.[3,4]

Dexmedetomidine is a centrally acting α2 adrenoreceptor agonist with sleep inducing, reduce anxiety, and analgesic-sparing properties,[5] which is the FDA approved sedative to use in Intensive Care Unit for up to 24 hours. It has been used for pre-medication, adjunct to general anaesthesia, and can decrease the need for opioids, inhalational anaesthetics and intravenous anaesthetics.[6–9] Experimental study conducted on rats, found dexmedetomidine, a very potent anti-nociceptive agent.[10] Previous studies revealed remarkable role of intrathecally dexmedetomidine in combination with hyperbaric bupivacaine in humans to produce the shorter onset of sensory and motor block (sensory block and motor block was 3.14±1.23 and 4.27±0.24 respectively),

prolong duration of block i.e. sensory regression to S1 is 327.22±21.11 and motor block regression to Bromage 0 is 305±9.78 minutes with preserved hemodynamic stability and lack of sedation was observed.[11] Dexmedetomidine also have a dose-dependent effect in spinal anaesthesia in reducing postoperative analgesia requirement.[12]

Dexmedetomidine was recently introduced in Pakistan, but its effectiveness was not assessed yet. By conducting this study, we assessed the effectiveness of dexmedetomidine based on the onset, duration and regression of sensory and motor block with is postoperative rescue analgesic requirement.

MATERIAL AND METHODS

This prospective comparative study was conducted by the Department of Anaesthesia for six months on patient's undergone subarachnoid block for lower abdominal surgeries at operation theatres of Liaquat National Hospital, Karachi, Pakistan. The sample size of 80 by taking mean of time in minutes of sensory blockade up to T10 among two groups, i.e., 4.7±2 and 4.34±0.74 respectively from the previous study at 90% power and 99% confidence level. 100 participants were taken for study after considering with-drawl and resist to give consent for participation. Patients were equally randomized into two groups, i.e., 50 patients in group N and 50 patients in group D10. Participants were assessed by pre-designed proforma based was based on following variables: onset, time to taken to reach sensory T10 and motor block Bromage 0, sensory regression S1, motor regression to reach Bromage 3, analgesia required post-op after surgery during 12 hours was recorded. Post-operatively hemodynamic stability was observed by monitoring heart rate, mean arterial pressure; oxygen saturation (SpO2), and pain score by using Visual analogue scale (VAS), was recorded initially every one hour for two hours, then every two hours for the next 8 hours, and then 12 hours. Permission was taken from the ethical committee of Liaquat National Hospital and Medical College. Data were analysed by using SPSS version 22. Quantitative characteristics were reported in mean and standard deviation, whereas, qualitative data were presented in percentages. Quantitative variables were checked for normality, Shapiro-Wilk test showed *p*-value >0.05. Hence data were normally distributed, and then sensory block and regression and surgical characteristics between both groups were assessed by applying parametric independent t-test and qualitative outcomes were compared between groups using Fisher exact/chi-square test. *p*-value <0.05 was considered significant.

RESULTS

Overall, 100 patients were included in this study, 50 participants were enrolled in each group. The average age of participants was 62±14 and 62±15, Group B and Group D, respectively. There was no significant difference in ASA was found in both groups. The majority of the surgeries were inguinal hernia mesh repair in both groups followed by open appendectomy, TURP, femur and tibia/fibula fracture, and above or below-knee amputation. There were no significant changes found in the socio-demographic characteristics of participants. (*p*-value = >0.05). **(**Table 1**)**

The sensory block, motor block, sensory regression and motor regression to reach T10, Bromage 3, S1 segment, and Bromage 0, respectively, showed significant changes after the addition of 10ug dexmedetomidine with 0.5% bupivacaine (10 mg). Rescue analgesia given with 12 hours post-operatively was also compared between both groups. Patients who were assigned in Group D reported less need to provide rescue analgesia as compared to another group. (Table 2). Surgery-related characteristics, i.e., the total amount of fluid followed by blood transfusion, nausea or vomiting experienced by patients, bradycardia, hypotension, and vasopressor or atropine given showed no significant changes, i.e., *p*-value = >0.05. (Table-3)

Table-1: Baseline Characteristics of Participants

Variables	Group N (n=50) (10 mg bupivacaine 0.5% + 0.5 ml normal saline)	Group D10 (n=50) (0.5% bupivacaine 10 mg + 10 ug Dexmedetomidine + 0.5 ml normal saline)	*p*-value
Age in years	62±14	62±15	0.121
Gender			
Male	29	50	0.193
Female	11	10	
ASA			
I	6	5	
II	33	27	0.304
III	11	18	
Surgeries Performed			
TURBT/TURP/URS	10	11	
ORIF Femur/Tibia-fibula	08	07	0.231
Open Appendectomy	12	10	
Inguinal hernia mesh repair	15	17	
Above/Below knee amputation	5	5	

Table-2: Characteristics of block onset and regression

Spinal block characteristics	Group N (n=50)	Group D10 (n=50)	*p*-value
Sensory block to reach T10	9.9±2.12	5.4±1.17	0.001
Motor block to reach Bromage 3	17±22	10.4±1.03	0.001
Sensory regression to S1 segment	163±24	413±46	0.001
Motor block regression to Bromage 0	145±25	307±18	0.001
Frequency of Analgesia received by patients after procedure within 12 hours (Rescue Analgesia)	1 1 5 31	0 0 8 05	0.001

Table-3: Characteristics of surgical procedures, post-operative incidents and management

Surgical Characteristics	Group N (n=50)	Group D10 (n=50)	P-value
Intravenous fluid given (ml)	980±273	1101±284	0.32
Duration of Surgery	48.9±9	57±26	0.84
Blood transfusion	3	2	0.69
Nausea/vomiting	3	3	1.00
Bradycardia	2	1	0.15
Hypotension	7	3	0.18
Vasopressor	5	2	0.24
Atropine	0	0	N/A

DISCUSSION

Several research studies have been carried out on the use of clonidine (Alpha 2 adrenergic agent) for analgesia and paint therapy. Dexmedetomidine also has similar properties to the addition of pharmacokinetic properties.[5] It was initially preferred in intensive care unit for sedative properties, but soon its' role in analgesia revealed and showed binding properties for A2R more than clonidine, medical practitioners started to prefer this as a systemic analgesic, mainly in pre-operative settings.[1,13]

The current study conducted on two groups, one group of patients received only 0.5% bupivacaine and normal saline. Whereas, another group was given 10 ug dexmedetomidine + 0.5% bupivacaine + 0.5 ml normal saline. Mustafa *et al*[13] conducted a study on three different groups, i.e., plain bupivacaine with normal saline, bupivacaine with 5 ug dexmedetomidine and bupivacaine with 10 ug and enrolled only 66 patients (21 in each group) and reported significant reduction or short onset of sensory block to reach T10 and motor block to reach Bromage 3 and prolonged sensory and motor regression in 10 ug group, as compare to other groups who received 5 ug dexmedetomidine and plain 0.5% bupivacaine, these findings show consistency with our study in which group who received 10 ug dexmedetomidine showed significant reduction and the short onset of sensory block to reach T10 and motor block to reach Bromage 3. Our study also reported fewer incidents of adverse effects as compared to a group who received bupivacaine alone which shows similarity with the study conducted by Mustafa *et al*. However, there was no significant difference between both groups, except hypotension which was significantly decreased in the previous study but not in the current study. The possible explanation could be the difference in sample size and surgical procedures. This can be justified by meta-analysis conducted on comparison of dexmedetomidine and fentanyl by Shujun *et. al*., which reported the lack of effect of dexmedetomidine on incidence of hypotension and bradycardia.[14] Findings related to effects of dexmedetomidine on short onset of sensory T10 and motor block Bromage 3 and prolonged sensory S1 and motor regression Bromage 0 also showed resemblance with study conducted by Gousheh *et al*., to assess the effectiveness of dexmedetomidine and morphine adjuvant with bupivacaine.[15]

Research carried out by Amit *et al*.[11] on 50 patients to compare the usage of bupivacaine alone and 5 ug dexmedetomidine, found no significant (>0.05) difference in the onset of sensory block to reach T10 and motor block to reach Bromage 3 between both groups. Hence, this study and the previous study conducted by Mustafa *et al*[13] proved that the usage of 10 ug Dexmedetomidine would be beneficial as compare to 5 ug Dexmedetomidine. However, the study found a significant (p<0.05) increase in sensory regression to reach S1 and motor regression to reach Bromage 0 in the group who received 5 ug dexmedetomidine.

A study carried out by Vidhi et al on four groups, i.e., Bupivacaine + Dexmedetomidine, bupivacaine + clonidine, bupivacaine + fentanyl, and bupivacaine + normal saline to assess the onset of sensory and motor block and duration of sensory and motor regression revealed that participants who were assigned in bupivacaine + dexmedetomidine showed prolonged sensory and motor regression. However, the onset of sensory and motor were not significant in all groups in contrary our study reported both early

onsets of sensory and motor block and prolonged duration of sensory and motor regression, this could be justified by the usage of 10 ug dexmedetomidine in the current study.[16]

Limitations: The present study also contains few limitations; dexmedetomidine was only compared with a dose of 10 ug however, previous studies suggested good results with 5 ug with few exceptions.

CONCLUSION

Our study concludes that the usage of 10 ug dexmedetomidine along with 0.5% bupivacaine reduced onset on sensory T10 and motor Bromage 3 and prolonged duration of sensory S1 and motor regression to reach Bromage 0, moreover minimal side effects and less use of rescue analgesic drugs was observed in 10 ug dexmedetomidine group, thus dexmedetomidine should be preferred pre-operatively in patients with TURP, Lower fracture, open appendectomy, inguinal hernia mesh repair and above or below-knee amputations.

AUTHORS' CONTRIBUTION

SSA, AA: Literature search, conceptualization of study design. KA: Write-up, data analysis, proof reading, literature search. NA: Literature search, data collection, data interpretation. AR: Data collection, data analysis. SSA, NA, AA, MR, AR, KA: Review and final approval.

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