e-ISSN: 0975-1556, p-ISSN:2820-2643

Available online on www.ijpcr.com

International Journal of Pharmaceutical and Clinical Research 2024; 16(8); 96-101

Original Research Article

Comparison of Morphine and Dexmedetomidine as Adjuvants to 0.5% Hyperbaric Bupivacaine in Spinal Anaesthesia in Lower Abdominal Surgeries

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Received: 25-05-2024 / Revised: 23-06-2024 / Accepted: 26-07-2024
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Conflict of interest: Nil

Abstract:

Introduction: Spinal anesthesia is the most frequently used method for lower abdominal surgeries, however, achieving postoperative analgesia still a problem because using pure local anesthetics without additives leads to a short duration of action and the early need for rescue analgesia in the postoperative period. Intrathecal injection of adjuvants to topical anesthetics can enhance the effects of anesthetic drugs and reduce their demand.

Aim and Objectives: The objective of this study was to compare the onset of sensory and motor blockade of morphine and dexmedetomidine and to compare their analgesic effect postoperatively when used as adjuvants to hyperbaric 0.5% heavy bupivacaine for spinal anesthesia.

Materials & Methods: After approval of Institutional Ethical Committee, this prospective comparative study was conducted on 72 patients aged 18-60 years posted for elective lower abdominal surgeries under spinal anaesthesia after taking informed consent. Patients were randomly divided into two groups; Group M received 15mg of 0.5% hyperbaric bupivacaine with 250mcg of morphine, while Group DM received 15mg of 0.5% hyperbaric bupivacaine with 5mcg of dexmedetomidine. The onset time for sensory, motor blockade, duration of anaesthesia and duration of analgesia, VAS score were observed in both the groups. The haemodynamic variables and any untoward side effects were noted in both groups.

Results: The duration of sensory and motor blockade was significantly longer in the dexmedetomidine group than in morphine group. Time for first rescue analgesia and total analgesic dose were similar in both groups. The pruritus was noticed only in morphine group, and there was no respiratory depression occurred in the two groups.

Conclusion: Intrathecal dexmedetomidine and morphine both provided good postoperative analgesia. Intrathecal dexmedetomidine produced prolongation of sensory and motor block of spinal anesthesia with less undesirable side effects than intrathecal morphine, thereby increasing the time for first rescue analgesia.

Keywords: Analgesia; Dexmedetomidine; Morphine; Spinal anesthesia.

Introduction

Spinal anaesthesia is the procedure that is utilized most frequently for lower abdominal operations since it is both incredibly cost-effective and simple to administer. On the other hand, spinal anaesthesia that is administered only using local anaesthetics is associated with a very short duration of action. As a result, early analgesic intervention is required during the postoperative period.

This presents a significant challenge for the successful management of postoperative pain. Research has been conducted on a variety of adjuvants, including clonidine and midazolam, amongst others, with the purpose of extending the duration of the effects of spinal anaesthesia. [1,2] Morphine, when combined with hyperbaric bupivacaine, has the ability to enhance the quality of subarachnoid block during the intraoperative and early postoperative phases of the procedure.[3] The incorporation of opioids into a local anaesthetic solution confers some drawbacks, including the induction of itching and the suppression of respiratory function.

A novel highly selective α2-agonist called dexmedetomidine is now being evaluated for its potential use as a neuraxial adjuvant. This is due to its ability to maintain stable hemodynamic circumstances, offer high-quality intraoperative and sustained postoperative analgesia, and be associated with few adverse effects. [4-6] Therefore, the current study was taken into consideration to assess the necessity for a better analgesic medication, possible side effects, and the effectiveness of intrathecal additive for post-operative analgesia in infraumbilical surgeries.

Aim and Objectives

The objective of this study was to compare the onset of sensory and motor blockade, block characteristics of morphine and dexmedetomidine and to compare their analgesic effect postoperatively when used as adjuvants to hyperbaric 0.5% heavy bupivacaine for spinal anesthesia.

Materials & Methods

The study was done as a hospital based prospective comparative study at the Department of Anaesthesiology, Sri Siddhartha Medical College and Research Centre, located in Tumkur, Karnataka, India. Patients aged 18-60 years, classified as ASA Class I & II, who were undergoing elective lower abdominal surgery under spinal anesthesia, were recruited for the research after obtaining clearance from the institutional ethics committee (Ref No.: SSMC/MED/IEC-143/July-2022) and informed consent from the patients.

Patients with pre-diagnosed systemic illness, gross spinal abnormality, localized skin infection, coagulation disorders, pregnant or lactational mothers, having BMI >29.9 kg/m^2, or unwilling to give consent were excluded from the study.

Sample size calculation was done by employing Purposive sampling technique & the formula for calculating the sample size was $n = 2[Z(1-\alpha/2) + Z(1-\beta)]^2 x\sigma^2/d^2$. The minimum sample size required after considering the non-response rate of 10%, the total sample size required was 36 in each group (total = 72).

All the selected 72 patients were allocated randomly into two groups after pre-anaesthetic evaluation and routine work-up.

- **Group M:** receiving intrathecal 0.5% hyperbaric Bupivacaine (15mg) + Morphine (250mcg)
- **Group DM:** receiving intrathecal 0.5% hyperbaric Bupivacaine (15mg) + Dexmedetomidine (5mcg)

On the operation table, routine monitoring of non-invasive blood pressure (NIBP), heart rate, electrocardiography (ECG), oxygen saturation (Spo2), end-tidal CO_2 ($EtCO_2$) was started & vital parameters were recorded throughout the intraoperative period and at the end of surgery.

Time of onset of sensory blockade, the height of sensory blockade, motor blockade as per Bromage scale, total duration of sensory blockade and motor blockade, quality of analgesia (visual analogue score), two-segment sensory regression time, time to first rescue analgesic, and number of rescue analgesics in 24 h were also monitored.

Observation parameters

- The sensory level was monitored every 2 min with cold swab method until it reached the T12 level of sensory block, at which surgery began when motor block reached grade -3 of the modified bromage scale.
- The sensory block duration was measured at 15-min intervals until it reached level L5. The motor block was recorded at 5-min intervals followed by 30-min intervals until the bromage scale reached zero.
- The post-operative pain was scored using a 10-point VAS at 30-min interval until the first demand of analgesic drug. When the VAS was greater than 4, if the patient requested analgesia, postoperative 75mg IV Diclofenac sodium was administered and recorded.
- The vital signs were recorded at time 0, 2, 5 min, then every 10 min for first hour and half-hourly until the end of surgery.
- Any side effects that occurred during the surgery or during the post-operative period were noted.

Statistical Analysis

Descriptive statistical analysis was carried out by mean and standard deviation for quantitative variables and frequency and percentages for categorical variables. The association between categorical variables was analyzed by using chi-square test. Treatment effect between groups was compared by applying independent samples t-test. Repeated measure and ANOVA was applied to test for difference in parameters at different time intervals. Statistical software SPSS version-20 was used for the analysis.

Results

Demographic data: The age, weight, height and duration of surgery were comparable in both groups. **[Table 1]**

Table 1: Demographic data

Variables		Group M (Mean±SD)	Group DM (Mean±SD)	P value
Age (in years)		43.25 ± 10.07	47.47 ± 9.59	0.073 **(NS)**
Gender (M:F)		10:26	11:25	0.795 **(NS)**
BMI		36.00 ± 23.25	36.00 ± 23.12	0.080 **(NS)**
ASA	I	17	17	>0.05 **(NS)**
	II	19	19	

NS- Not Significant (p>0.05)

Haemodynamic variables: In the present study, there is a significant difference in the variability of PR, DBP, SBP and MAP between the two study groups at all the time intervals (P<0.001). The haemodynamics were more stable with Dexmeditomidine group. **[Figure 1-4]**

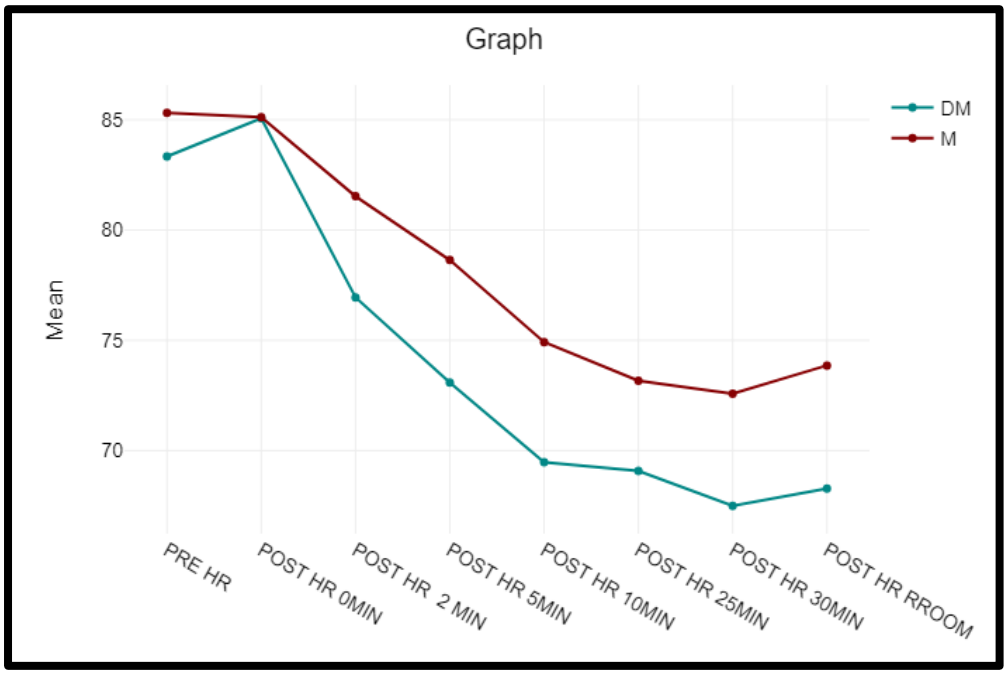

Figure 1: HR variability

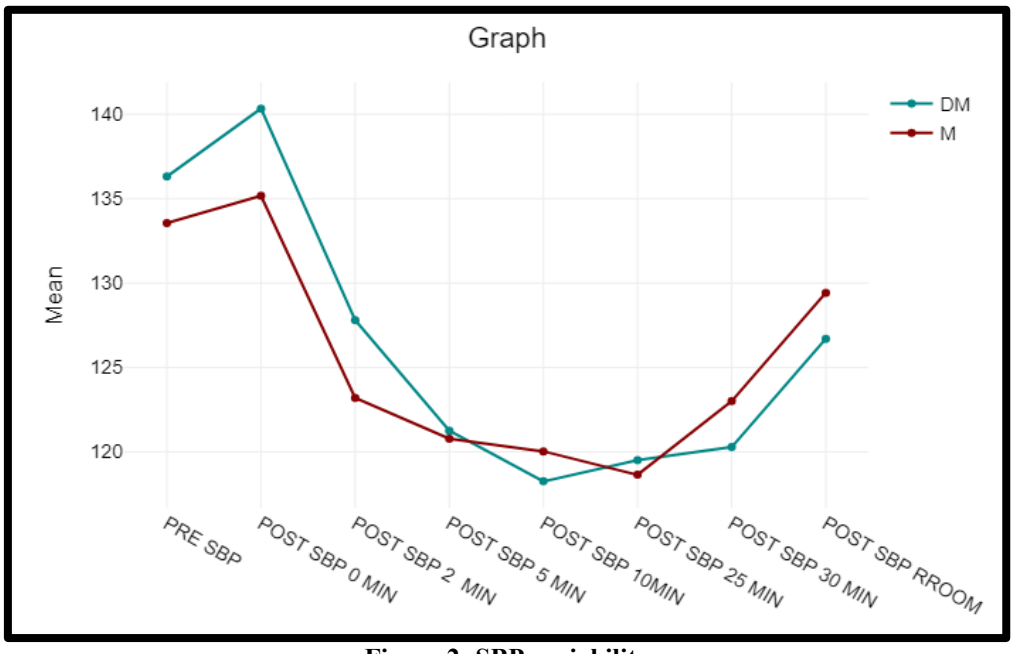

Figure 2: SBP variability

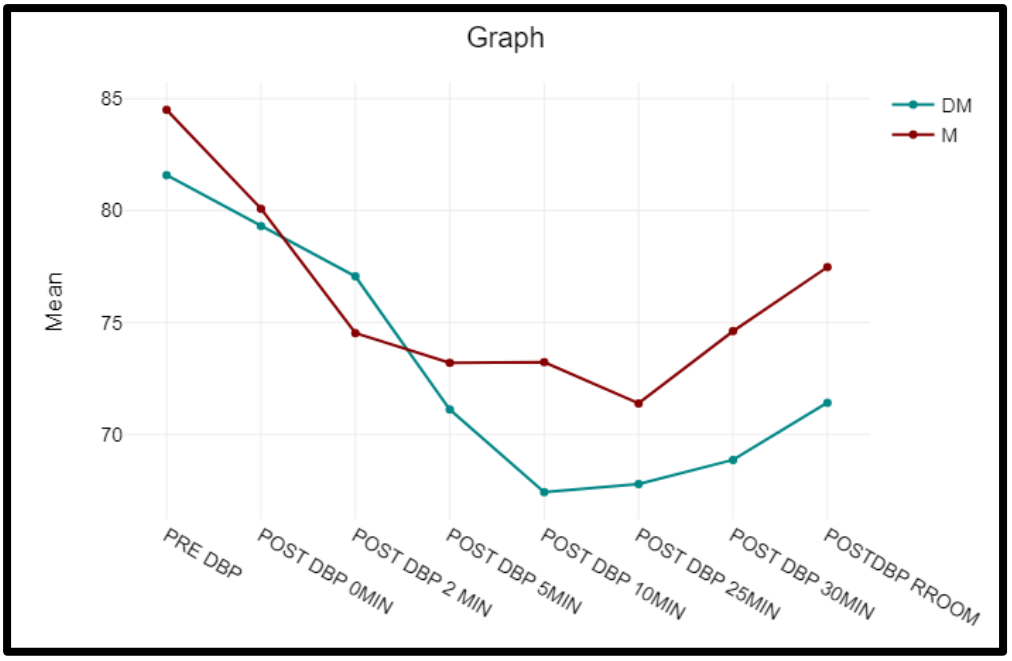

Figure 3: DBP variability

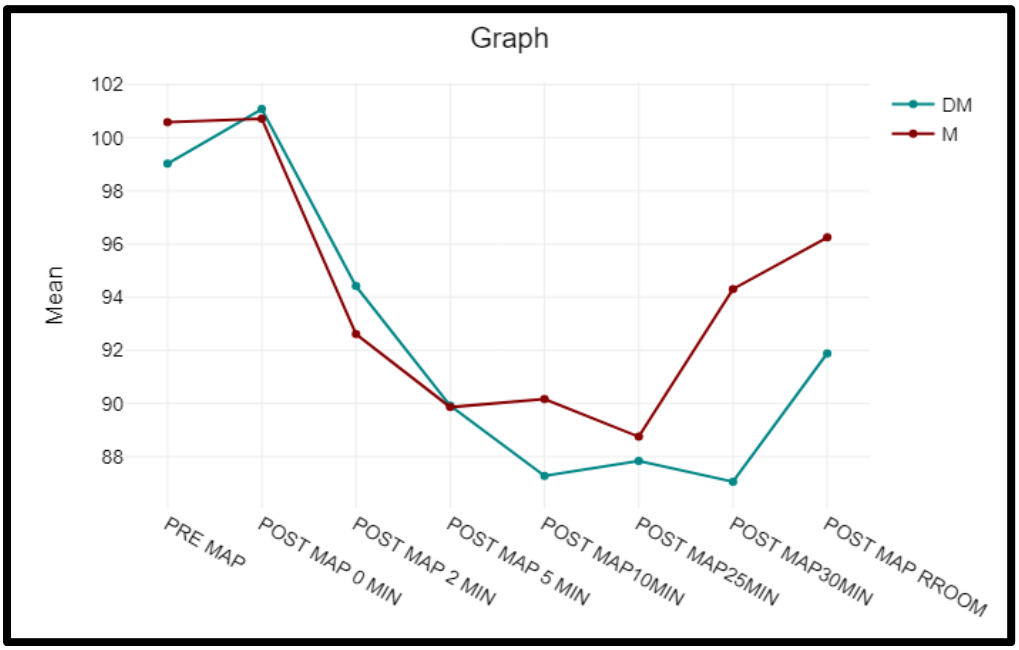

Figure 4: MAP variability

Onset of sensory/motor blockade: In the present study, the mean sensory block onset and the mean motor block onset didn't differ significantly between the groups (P>0.05). The time to rescue analgesia was found to be longer in Dexmedetomidine group when compared to Morphine group, 377.22 vs. 362.19, (P<0.001). **[Table 2]**

Table 2: Block characteristics & time to rescue analgesia

Variables	Group M (Mean±SD)	Group DM (Mean±SD)	P value
Onset of Sensory blockade (mins)	2.56±0.77	2.78±0.76	0.223 **(NS)**
Onset of Motor blockade (mins)	1.58±0.84	1.72±0.88	0.496 **(NS)**
Duration of Sensory blockade (mins)	362.19±25.62	377.22±29.44	<0.001 **(S)**
Duration of Motor blockade (mins)	247.25±25.98	362.61±39.29	<0.001 **(S)**
Time to rescue analgesia (min)	362.19±25.62	377.22±29.44	<0.001 **(S)**

NS- Not Significant (p>0.05), S- Significant (p<0.05)

There is a significant difference between the groups of the first factor PRE VAS, VAS 10MIN, VAS 30MIN, VAS 2HR and VAS 6HR in relation to the dependent variable. **[Figure 5]**

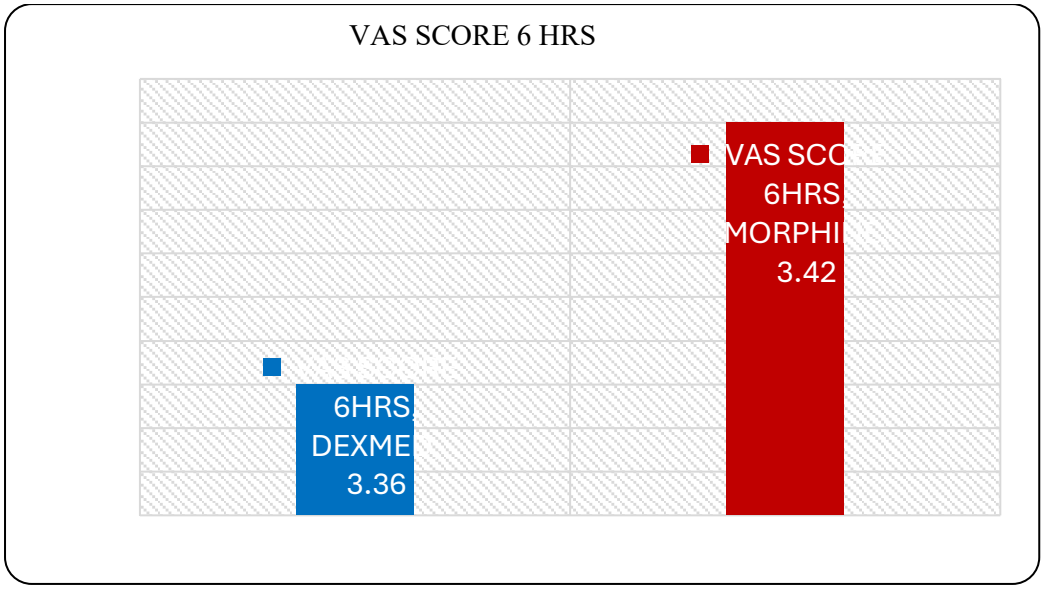

Figure 5: VAS score

The difference between Dexmedetomidine and Morphine with respect to the dependent variable complications was not statistically significant (P = 0.05).

Discussion

When it comes to surgical procedures involving the lower abdomen, a subarachnoid block is a tried-and-true method. A further issue is that postoperative analgesia following spinal anaesthesia only lasts for a limited period of time. There are a variety of adjuvants that have been administered intrathecally in order to lengthen the duration of the subarachnoid block's analgesic effects.

In the present study, there is a significant difference in the variability of PR, DBP, SBP and MAP between the two study groups. The hemodynamics was more stable with Dexmedetomidine group. In a study by Ahmed et al, [7] There was a progressive decrease in heart rate in both groups which was insignificant except in 60, 70min readings but this decrease did not need atropine administration. On the other hand, there was no significant difference between the two groups as regard systolic, diastolic and mean blood pressure except at 60, 70 min readings of systolic blood pressure.

In the present study, the mean sensory block onset and the mean motor block onset didn't differ significantly between the groups. In comparison to 200 mcg of intrathecal morphine, the results of the Khandelwal et al [8] investigation demonstrated that spinal bupivacaine supplemented with 5 mcg of dexmedetomidine caused a lasting analgesic effect and motor blockage. The current study's findings are consistent with research conducted by Kurhekar et al. [9] and Qi et al.[10] In a study by Gousheh et al, [11] findings also showed that dexmedetomidine resulted in a shorter time to reach sensory and motor block than morphine did. The sensory and motor block duration was longer in the Bupivacaine + Dexmedetomidine group than in the

Bupivacaine + Morphine group and the time to first analgesic demand was longer in the

Bupivacaine + Dexmedetomidine group than in the Bupivacaine + Morphine group.

In a study by Ahmed et al, [7] there was no significant difference between the two study groups as regard onset and time to reach the highest level of sensory block, however, there was a significant difference between the two groups in the time for the 2 segment regression which is longer in dexmedetomidine group (94±27min) than in morphine group (77.8± 22min). In Mahendru et al, [12] the mean time of two segment sensory block regression was 147 ± 21 min in Group BD, 117 ± 22 in Group BC, 119 ± 23 in Group BF, and 102 ± 17 in Group BS (P > 0.0001). The regression time of motor block to reach modified Bromage zero (0) was 275 ± 25, 199 ± 26, 196 ± 27, 161 ± 20 in Group BD, BC, BF, and BS, respectively (P > 0.0001).

In the present study, the time to rescue analgesia was found to be longer in Dexmedetomidine group when compared to Morphine group, 377.22 vs. 362.19. This difference was statistically significant. In Ahmed et al, [7] there was no significant difference between the two groups as regard time

for first rescue analgesia and the total analgesic dose required between the two groups. Group Bupivacaine + Dexmedetomidine had experienced a considerably longer time to the first rescue analgesia than Group Bupivacaine + Morphine. In Mahendru et al, [12] Dexmedetomidine group showed significantly less and delayed requirement of rescue analgesic.

Opioids are a typical kind of analgesic used for the purpose of controlling postoperative pain; nevertheless, they are associated with a number of undesirable side effects, including respiratory depression, nausea, vomiting, and pruritus. The incidence of pruritus in the morphine group who participated in our study was forty percent, which is consistent to the findings of other investigations. [3,4] It is clear that the dexmedetomidine group did not experience any pruritus, which is a significant advantage in comparison to the morphine group. In the group that was given morphine, the percent of people who experienced nausea was 29%, which is a larger percentage than what Khandelwal et al reported.[8]

Conclusion

The present study concluded that intrathecal dexmedetomidine resulted in a motor block that began more quickly and lasted for a longer period of time than intrathecal morphine. The findings of these trials are comparable to those of the research that compared intrathecal dexmedetomidine with morphine and discovered that intrathecal dexmedetomidine caused a longer blockage of the motor response.

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