ORIGINAL RESEARCH PAPER
Volume - 13 | Issue - 03 | March - 2024 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

"A COMPARATIVE STUDY OF 0.5% BUPIVACAINE HEAVY VERSUS 0.5% BUPIVACAINE HEAVY PLUS DEXMEDETOMIDINE IN SPINAL ANESTHESIA FOR INFRAUMBILICAL SURGERIES: A PROSPECTIVE, RANDOMIZED STUDY"

Anaesthesiology

Dr Gowri Shankar B Assistant Professor, Department Of Anaesthesia, Surabhi Institute Of Medical Sciences, Siddipet, Telangana.

Dr Keerthana N Assistant Professor, Department Of Anaesthesia, Osmania medical college, hyderabad, Telanagna.

Dr Raju Bhukya* Assistant Professor, Department Of Anaesthesia, Surabhi Institute Of Medical Sciences, Siddipet, Telangana. *Corresponding Author

ABSTRACT

Background: Ensuring appropriate intraoperative anesthesia and postoperative pain management for infraumbilical surgery remains a significant challenge. However, the use of adjuvants such as dexmedetomidine in spinal anesthesia has been shown to extend the duration of pain relief in the postoperative period. Recent studies have demonstrated substantial improvements in postoperative pain management and stable intraoperative conditions when dexmedetomidine is used as an adjuvant in spinal anesthesia. To assess the efficacy of adding dexmedetomidine to bupivacaine heavy in spinal block compared to using plain bupivacaine heavy in patients undergoing infraumbilical surgeries, a prospective, randomized study was conducted. **Methods:** Sixty patients scheduled for infraumbilical surgeries were randomly assigned to two groups: one group received dexmedetomidine along with 0.5% bupivacaine heavy, and the other group received plain 0.5% bupivacaine heavy in equal volume. **Results:** The beginning of sensory blockade in Group C occurred at (151.66 ± 15.33 seconds) and in Group D at (128.66 ± 11.36 seconds), with a statistically significant difference ($p < 0.001$). In Group C, the peak sensory block was reached at (9.41 ± 0.56) and in Group D at (7.33 ± 0.73). The highest dermatomal sensory level observed in Group C was (6.8 ± 1.09 minutes) and in Group D was (5.96 ± 0.67). The onset of motor block in Group C was at (178 ± 16.48 seconds) and in Group D and (140 ± 13.89 minutes). Complete motor block was achieved in Group C at (8.6 ± 0.57 minutes) and in Group D at (6.67 ± 0.63 minutes) ($p < 0.001$). The regression of sensory block to two segments in Group C was (92.83 ± 8.37 minutes) and in Group D (146.83 ± 9.14 minutes) with $p < 0.001$). The regression to T12 in Group C was (139.5 ± 13.60) and in Group D at (208.116 ± 16.21). Complete recovery of motor block was observed in Group C (179.16 ± 14.62) and Group D (265.66 ± 19.24). The total duration of analgesia in Group C was (187.5 ± 15.07 minutes) and in Group D was (301 ± 25.77 minutes). **Conclusion:** Group D exhibited a rapid onset of sensory and motor block, and the duration of the motor and sensory block was significantly longer than in Group C. The total analgesia duration in Group D was also longer. Moreover, adding dexmedetomidine to spinal anesthesia provided better surgical conditions and analgesia compared to plain bupivacaine.

KEYWORDS

Spinal Block, Bupivacaine, Dexmedetomidine

INTRODUCTION

Spinal anesthesia has become the preferred method for surgeries below the diaphragm, including lower limb surgeries, owing to its fast onset, reliability, and ease of use. Spinal anesthesia uses a small amount of anesthetic, offers quick action, and provides excellent muscle relaxation. However, it has a relatively short duration of action and is associated with postoperative pain when the effects wore off.

James Leonard Corning, a neurologist in New York, is credited with the discovery of spinal anesthesia. Heinrich Irenaeus Quincke and Essex Wynter standardized the lumbar puncture procedure in 1891. In 1898, August Bier administered the first planned spinal anesthesia for surgery.

Local anesthetics such as lignocaine and bupivacaine have been used for spinal anesthesia for many years; however, lignocaine has neurotoxic effects, and bupivacaine has cardiotoxic effects. Ropivacaine and levobupivacaine, which have fewer side effects than levobupivacaine, have been introduced as alternatives.

Currently, 0.5% bupivacaine is the most commonly used technique for spinal anesthesia in infraumbilical surgery. Owing to the limitations of local anesthetics, such as 0.5% bupivacaine, insufficient duration of anesthesia and inadequate postoperative analgesia can occur. Visceral pain is a significant component of several clinical pain states, and deep pain associated with the viscera is distinct from that associated with somatic or cutaneous pain. Surgical procedures in the infraumbilical region require a sufficient depth of regional anesthesia, which is typically not achievable with intrathecal bupivacaine alone. Therefore, it is crucial to identify newer techniques and drug combinations that can prolong the duration of local anesthesia and provide sufficient analgesia in the postoperative period. Several adjuvants, including opioids such as morphine and fentanyl, and vasoconstrictors such as adrenaline, ketamine, midazolam, and clonidine, have been added to local anesthetics to optimize the duration of anesthesia and postoperative analgesia. These adjuvants offer benefits, such as improved quality of anesthesia, faster onset, and prolonged postoperative analgesia. Additionally, experimental studies have shown that intrathecally administered opioids and alpha 2 adrenergic agonists can relieve visceral pain. The addition of opioids such as Morphine, Fentanyl, Buprenorphine, and sufentanil overcomes the limitation of inadequate duration of anesthesia with local anesthetics, as demonstrated by the presence of μ-opioid receptors in the substantia gelatinosa of the spinal cord.

AIMS AND OBJECTIVES

After getting institutional ethical committee approval the present study "Effect of adding Dexmedetomidine to intrathecal Bupivacaine heavy on spinal block versus plain Bupivacaine heavy for infraumbilical elective surgeries" was conducted with the following aims and objectives:

Primary:

To compare sensory and motor blockade characteristics with -

1. Onset of sensory block.
2. Onset of motor block.
3. Time to achieve maximum sensory block.
4. Time to achieve maximum motor block.
5. Maximum dermatomal levels were achieved.
6. Time for two-segment regression.
7. Time to regression to T12.

Secondary:

1. To study and compare hemodynamic changes between the 2 groups.
2. To study the incidence of side effects in the two groups.
3. To study and compare the duration of postoperative analgesia between the two groups.

Review Of Literature

This literature review encompasses multiple studies exploring the effects of incorporating dexmedetomidine as an adjuvant to bupivacaine in spinal anesthesia across various surgical procedures. A more detailed summary of the findings of each study is presented.

Kanazi et al. (2006): Explored the impact of dexmedetomidine or clonidine supplementation on intrathecal bupivacaine during transurethral resection of prostate or bladder tumors. Both

dexmedetomidine and clonidine significantly reduced the onset time of motor block and extended the duration of sensory and motor blocks compared to bupivacaine alone.

Al-Mustafa et al. (2009) investigated the dose-dependent effects of dexmedetomidine added to bupivacaine in neuraxial anesthesia. Dexmedetomidine hastened the onset of sensory and motor block while significantly prolonging their duration.

Al-Ghanem et al. (2009) Comparison of dexmedetomidine and fentanyl added to bupivacaine for spinal anesthesia in women undergoing vaginal reconstructive surgery. Dexmedetomidine supplementation resulted in prolonged motor and sensory blocks compared to fentanyl.

Hala et al. (2011) studied the effect of intrathecal dexmedetomidine on sensory and motor block durations and postoperative analgesic requirements. Dexmedetomidine significantly prolonged sensory and motor blocks and reduced postoperative pain scores.

Gupta et al. (2011): Investigated the combination of intrathecal ropivacaine and dexmedetomidine and found that it prolonged the duration of sensory and motor blocks and provided excellent postoperative analgesia.

Rajni Gupta et al. (2011):Explored the effects of dexmedetomidine or fentanyl added to hyperbaric bupivacaine for spinal anesthesia were explored. Dexmedetomidine was associated with prolonged sensory and motor blocks, hemodynamic stability, and reduced need for rescue analgesia compared to fentanyl.

Shukla et al. (2011): Studied the effects of dexmedetomidine and magnesium sulfate added to hyperbaric bupivacaine. Dexme detomidine resulted in a rapid onset and prolonged duration of anesthesia compared to magnesium sulfate.

Mohamed et al. (2012) compared intrathecal dexmedetomidine alone and in combination with fentanyl in major abdominal cancer surgery. Dexmedetomidine alone improved postoperative analgesia and reduced analgesic consumption.

Jamliya et al. (2013) evaluated the adjuvant effects of intrathecal dexmedetomidine in elderly patients undergoing prostate surgery. Dexmedetomidine demonstrated a faster onset, longer duration of sensory block, and prolonged postoperative analgesia.

Maharani et al. (2013): Compared dexmedetomidine and buprenorphine as adjuvants to bupivacaine for lower abdominal and limb surgeries. Dexmedetomidine shortened the onset of sensory blockade, prolonged sensory and motor block durations, and delayed the time for the first analgesic request compared to buprenorphine.

In summary, these studies consistently indicate that adding dexmedetomidine to bupivacaine during spinal anesthesia enhances the quality and duration of sensory and motor blocks, providing promising outcomes for improved perioperative care.

MATERIALS AND METHODS:

The current study compared intrathecal dexmedetomidine (5 µg) as a supplement to 0.5% (15 mg) hyperbaric bupivacaine and 0.5% (15 mg) hyperbaric bupivacaine in infraumbilical surgery performed at a tertiary care center in the Department of Anesthesiology of the Surabhi Institute of Medical Sciences. This study was initiated only after the institutional ethics committee obtained approval from March 2022 to November 2023.

Study Design

This was a prospective randomized clinical study.

Inclusion criteria

1. ASA grade I or II for either sex.
2. Age between 18-60 years.
3. Height between150-170 cm.
4. Weight between 50-70 kgs
5. Patients undergoing elective infraumbilical surgery
6. Patient willing to undergo surgery under regional anaesthesia

Exclusion criteria

1. The patients were not willing to undergo the procedure.
2. Contraindication to spinal/epidural anesthesia, for example, bleeding diathesis, local infection, and patients on anticoagulants.
3. Patients with spinal deformities.
4. History of hypersensitivity to any opioid or local anesthetic agent.
5. History of cardiovascular diseases, such as Arrhythmias, Ischemic heart disease.
6. Liver, Respiratory, Kidney, Endocrine diseases.
7. Pregnant patients.

METHODOLOGY

After obtaining approval from the institutional ethical committee and obtaining written informed consent, 60 ASA grade I and II adult patients of either sex undergoing elective infraumbilical surgeries under spinal anesthesia were divided into two groups of 30 patients each.

Patient Preparation

Patients scheduled for elective infraumbilical surgery were included in the study, and informed consent was obtained from all the patients. To allow sufficient time for informed consent, patients were provided with written information at the outpatient preoperative evaluation clinic a few days before the actual operation.

A pre-anesthetic assessment was performed on the participating subjects. Investigations such as complete blood count, blood group and cross-match, blood sugar, blood urea, urine analysis, BT, and CT were advised. Electrocardiogram, chest X-ray and other investigations like LFT, KFT, and coagulation profile were done in all patients above 45 years or more and when required according to history, clinical examination in younger patients as well.

All patients were informed of the procedure, and informed consent was obtained. Patients fasted overnight fasting for 8-10 hr. Vitals were noted in the pre-anesthesia room. No premedication was administered to any of the patients. On the operation table, baseline monitoring devices for ECG, SpO2, and non-invasive blood pressure were attached to the patient. Pulse rate, systolic blood pressure, diastolic blood pressure, respiratory rate, oxygen saturation, and visual analog scale (VAS) scores were recorded before administering the subarachnoid block. A wide bore 18-20G intravenous cannula was inserted into the peripheral vein of the arm.

The patients were randomly allocated to two groups of 30 patients each.

Group C: 15mg hyperbaric Bupivacaine (0.5%, 3ml) + 0.5ml of normal saline

Group D: 15mg hyperbaric Bupivacaine (0.5%, 3ml) + 5µg Dexmedetomidine in 0.5ml of normal saline

Dexmedetomidine (100 µg/ml) was diluted with preservative-free normal saline to 10µg/ml. 0.5 ml of dexmedetomidine (10µg/ml) and preservative normal saline were added to 3 ml of 0.5% hyperbaric bupivacaine in a 5 ml syringe. The total injected volume was 3.5 ml in each group.

Monitoring

Baseline pulse, blood pressure, and respiratory rate were recorded. Surgery was performed under spinal anesthesia. Intraoperative monitoring included pulse rate, BP, ECG, RR, and SpO2. The readings of pulse rate, SBP, DBP, SpO2, and RR were taken at 2 min intervals for the first 10 min, then every 5 minutes interval till 30 min, then at 15 minutes interval until 60 min, then every hour until 4 h, and then 2 h up to 8 h. Intraoperatively, the fluid was maintained with Ringer's lactate.

Procedure Of The Block

Patients were placed in the left lateral position on the operation table with strict aseptic precautions, and a midline approach subarachnoid block was achieved in the L3-L4 space with a 23G disposable Quincke's spinal needle with a cutting bevel. The drug was injected after free-flow and clear aspiration of CSF over 10-15 seconds.

Patients were immediately placed in the supine position slowly and given oxygen 4lit/min a Venturi mask. The onset of sensory analgesia was assessed using a pinprick.

The duration of drug injection was noted and recorded as 0. The

following parameters were observed and recorded:

1. Time to onset of sensory block.
2. Time to onset of motor blockade.
3. Time to achieve maximum sensory level.
4. Time to achieve maximum motor blockade.
5. Maximum sensory level achieved
6. Degree of motor blockade
7. Duration of surgery
8. Time to two-segment sensory regression.
9. Time to regression to T12
10. Total duration of motor block.
11. Total duration of analgesia.
12. Time of rescue analgesia.
13. Quality of anaesthesia, quality of analgesia and amount of analgesic required postoperatively

The start of monitoring was taken from the time the drug was injected into the intrathecal space. (T=0).

1. Time of onset of sensory block
It was defined as the time interval between the completion of injection of the study drug and the onset of complete loss of sensation to pinprick at the level of lumbar dermatome 1 using the non-traumatic pin-prick method tested immediately after making the patient supine.

2. Time of onset of motor block
The time for onset of motor block was subjectively assessed by the patient from the time of injection of the drug into the subarachnoid space until the onset of feeling of heaviness in the legs.

3. Time to achieve maximum sensory level
The duration from injection of the study drug and the time to the maximum cephalic sensory level achieved was noted in minutes. It was tested using a pinprick with a sterile blunt 23G hypodermic needle. Patients were tested every 2 min for 10 min, every 5 min for 30 min, or until the start of the surgery, whichever occurred earlier.

4. Time to achieve maximum motor blockade
The maximum block was defined as the time taken from completion of intrathecal injection to the inability of the patient to move legs or feet.

5. Maximum sensory level achieved
This was defined as the highest dermatomal level of sensory blockade.

6. Degree of motor blockade
This was assessed by Modified Bromage Scale (ANNEXURE

7. Time to two-segment sensory regression
This was defined as the time taken for the sensory level to regress from the highest level to the two segments below.

8. The time to regression to T12.
It was defined as the time taken for the sensory level to regress from the highest level to the dermatome level T12.

9. Total duration of motor blockade
The time taken from injection of the study drug to regression of motor block to Bromage grade 0 was noted in minutes.

10. Total duration of analgesia
The total duration of analgesia was defined as the time between the administration of the local anesthetic and the onset of tolerable pain (VAS score ≥ 0) at rest.

11. Time of rescue analgesia
It was defined as the time from intrathecal injection to a VAS score greater than or equal to 4 at rest, requiring supplementary (rescue) analgesia in the form of inj. diclofenac sodium intramuscular at a dosage of 1.5 mg/kg.

12. Postoperative VAS score
VAS scores were used to assess the quality of anesthesia during surgery, while the quality of analgesia and amount of analgesic were required postoperatively. The visual analog scale (VAS) score (ANNEXURE 1) was used intraoperatively and postoperatively at 0, 60, 120, 180, 240, 360, 480, 12, and 24 h. When the score was >4, diclofenac was administered intramuscularly as a rescue analgesic at a dosage of 1.5 mg/kg.

Pain severity was measured using a 10 cm visual analog scale (VAS). VAS was assessed on a 10 cm (100 mm) pain scale, with 0 indicating no pain and 10 cm indicating the worst possible pain. Patients were asked to indicate pain intensity on the scale. The Inj. Diclofenac sodium 75 mg was administered intramuscularly as the first rescue analgesic when the VAS score was ≥ 4. Analgesic was administered subsequently whenever the VAS score was 4 or higher, until 24 h postoperatively. The total amount of analgesics required within 24 h was recorded.

Statistical Analysis:
Demographic and hemodynamic parameters are expressed as mean ± standard deviation (SD), and categorical variables are expressed as actual numbers and percentages. One-way ANOVA and post-hoc multiple comparisons were used to compare demographic parameters among the groups, while repeated-measures ANOVA and one-way ANOVA were used to compare hemodynamic parameters at different time points. The chi-square test was used to compare the postoperative complications between the groups. Statistical software STATA version 10.0 and SPSS version 16.0, were used for statistical analysis, with a significance level of 5%. Microsoft Word and Excel were used to generate the graphs and tables, respectively.

OBSERVATIONS AND RESULTS

Table no. 1 Comparison of Demographic Characteristics, including Age, Height and Weight.

	Group C	Group D	p-value
Age (years)	41.83 ± 9.02	39.83 ± 10.40	0.5779, NS
Height (cm)	160.13 ± 4.48	159.1 ± 3.48	0.2602, NS
Weight (kg)	55.9 ± 7.31	51.56 ± 4.94	0.4250, NS

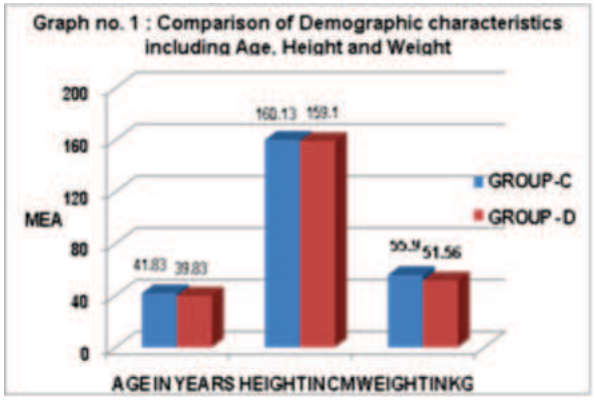


Table no. 2 Comparison of Demographic Characteristics including Gender

	Group C	Group D	p-value
Male	17	16	1.00, NS
Female	13	14	
Total	30	30	

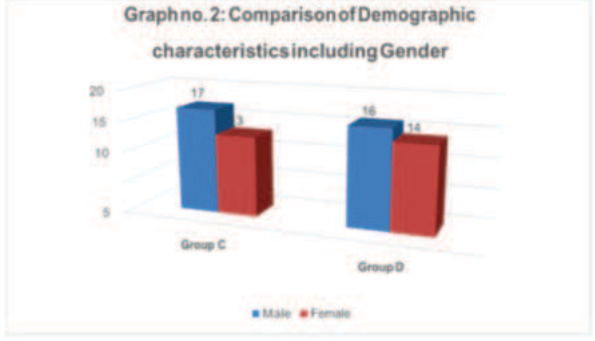
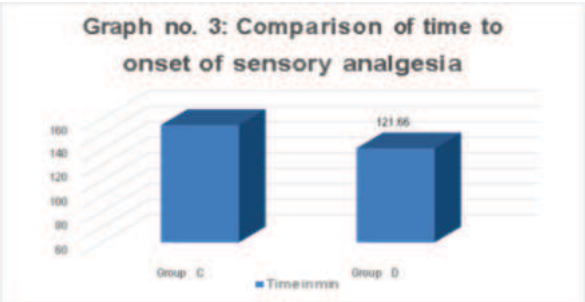


Table no. 3: Comparison of time to onset of sensory analgesia

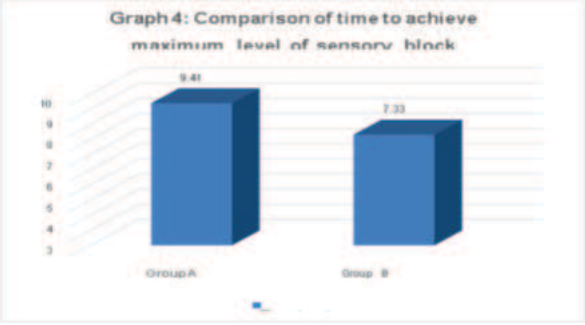
Time (sec)	Group C	Group D
91-120	0 (0%)	11 (36.7%)
121-150	19 (63.3%)	19 (63.3%)
151-180	11 (36.7%)	0 (0%)
Total	30 (100%)	30 (100%)
MEAN ± SD	151.66 ± 15.33 sec	128.66 11.36 sec



Mean time for the onset of sensory block was significantly longer (p<0.001) in group C (151.66 ± 15.33 sec) when compared to group D (128.66 ± 11.36 sec).

Table no. 4 : Comparison of time to achieve maximum level of sensory block

Time (min)	Group C	Group D
6-7	0 (0%)	7 (23.3%)
7-8	0 (0%)	14 (46.7%)
8-9	3 (10%)	7 (23.3%)
9-10	18 (60%)	2 (6.7%)
10-11	9 (30%)	0 (0%)
Total	30 (100%)	30 (100%)
MEAN ± SD	9.41 ± 0.56 min	7.33 ± 0.73 min
Comparison	Group C vs. Group D	
p-value	<0.001, HS	



The mean time to achieve maximum sensory block in group C (9.41 ± 0.56 min) was significantly longer (p<0.001) than that in group D (7.33 ± 0.73 min).

Table no. 5 : Comparison of highest dermatomal sensory level achieved

Sensory level	Group C	Group D
T5	0 (0%)	5 (16.7%)
T6	18 (60%)	23 (76.7%)
T7	2 (6.7%)	0 (0%)
T8	9 (26.7%)	2 (6.7%)
T10	1 (3.3%)	0 (0%)
TOTAL	30 (100%)	30 (100%)
MEAN ± SD	6.8 ± 1.09	5.96 ± 0.67
Comparison	Group C vs. Group D	
p-value	0.001, HS	

The mean dermatomal level achieved in group C (T 6.8 ± 1.09) was statistically significant compared to that in group D (T 5.96 ± 0.67).

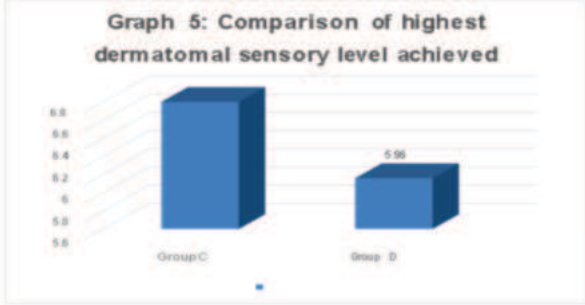


Table no. 6 : Comparison of time to onset of motor blockade

Time (sec)	Group C	Group D
90-120	0 (0%)	5 (16.7%)
121-150	2 (6.7%)	20 (66.7%)
151-180	21(76.7%)	5 (16.7%)
181-210	7(23.3%)	0 (0%)
TOTAL	30 (100%)	30 (100%)
MEAN ± SD	178.0 ± 16.48 sec	140.0 ± 13.89 sec
Comparison	Group C vs. Group D	
p-value	<0.001, HS	

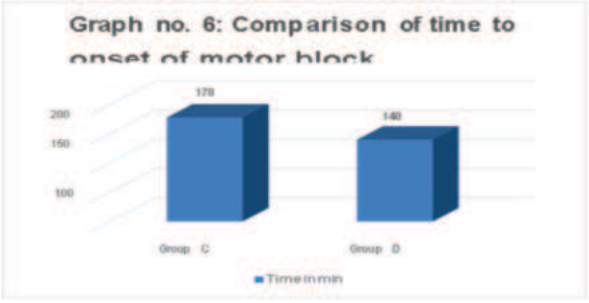


Table no. 7: Comparison of time to achieve complete motor blockade

Time (min)	Group C	Group D
5-6	0 (0%)	10 (33.3%)
6-7	1 (3.3%)	16 (53.3%)
7-8	8 (26.7%)	4 (13.3%)
8-9	18 (60%)	0 (0%)
9-10	3 (10%)	0 (0%)
TOTAL	30 (100%)	30 (100%)
MEAN ± SD	8.6 ± 0.57 min	6.67 ± 0.63 min
Comparison	Group C vs. GrouD	
p-value	<0.001, HS	

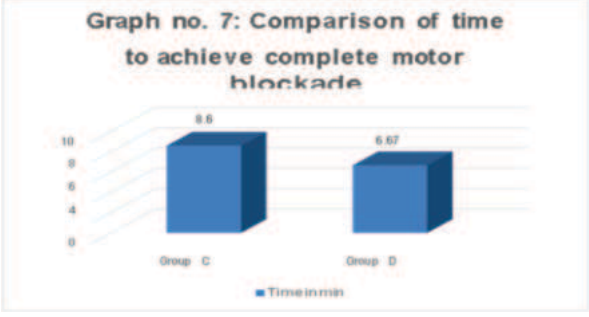


Table no. 9 : Comparison of time of regression to T12

Time (min)	Group C	Group D
90-120	4 (13.3%)	0 (0%)
121-150	24 (80%)	0 (0%)
151-180	2 (6.7%)	3 (10%)
181-210	0 (0%)	17 (56.7%)
211-240	0 (0%)	10 (33.3%)
TOTAL	30 (100%)	30 (100%)
MEAN ± SD	139.5 ± 13.60 min	208.116 ± 16.21 min
Comparison	GroupC vs GroupD	
p-value	<0.001, HS	

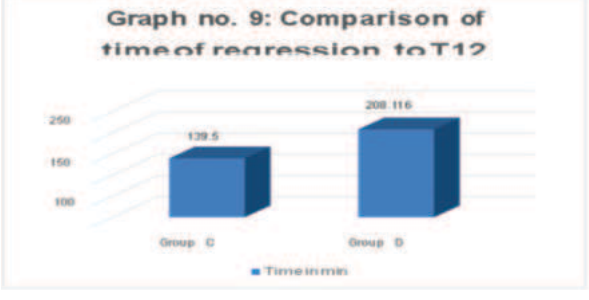


Table no. 10 : Comparison of total duration of motor blockade

Time (min)	Group C	Group D
150-180	18 (60%)	0 (0%)
181-210	12 (40%)	0 (0%)
211-240	0 (0%)	6 (20%)
241-270	0 (0%)	15 (50%)
271-300	0 (0%)	9 (30%)
TOTAL	30 (100%)	30 (100%)
MEAN ± SD	179.16 ± 14.62 min	265.66 ± 19.24 min
Comparison	Group C vs. Group D	
p-value	<0.001, HS	

Table no. 11 : Comparison of duration of complete analgesia

Time (min)	Group C	Group D
120-150	1 (3.3%)	0 (0%)
150-180	12 (40%)	0 (0%)
181-210	17 (56.7%)	0 (0%)
211-240	0 (0%)	0 (0%)
241-270	0 (0%)	6 (20%)
271-300	0 (0%)	11 (36.7%)
301-330	0 (0%)	11 (36.7%)
331-360	0 (0%)	2 (6.7%)
TOTAL	30 (100%)	30 (100%)
MEAN ± SD	187.5 ± 15.07 min	301 ± 25.77 min
Comparison	Group C vs. Group D	
p-value	<0.001, HS	

Table no. 12: Comparison of time of rescue analgesia

Time (min)	Group C	Group D
181-210	9 (30%)	0 (0%)
211-240	15 (50%)	0 (0%)
241-270	6 (20%)	0 (0%)
271-300	0 (0%)	4 (13.3%)
301-330	0 (0%)	5 (16.7%)
331-360	0 (0%)	10 (33.3%)
361-390	0 (0%)	8 (26.7%)
391-420	0 (0%)	3 (10%)
TOTAL	30 (100%)	30 (100%)
MEAN ± SD	228.16 ± 17.54 min	358 ± 32.63 min
Comparison	Group C vs. Group D	
p-value	<0.001, HS	

Table no. 13 : Comparison of mean pain scores at various time intervals

Time (min)	Group C	Group D	p-value
0	1.53 ± 1.96	1.46 ± 2.12	
60	0	0	0.9924, NS
120	0	0	0.9924, NS
180	1 ± 1.20	0	0.1780,NS
240	1.6 ± 2.09	0	0.0504, NS
360	0	2.56 ± 2.04	0.0001, HS
480	1.93 ± 0.25	0	0.00006, HS
12 hr	2.36 ± 0.49	1.56 ± 0.50	0.3824, NS
24 hr	2.23 ± 0.43	1.66 ± 0.48	0.6146, NS

DISCUSSION

As an anesthesiologist, the responsibility to alleviate patient pain comes with the privilege of practicing this medical specialty. With advancements in regional anesthesia and the increased availability of medications, spinal anesthesia has become a dependable and preferred option for lower abdominal surgery. Various drugs, such as procaine, mepivacaine, tetracaine, lidocaine, bupivacaine, levobupivacaine, and ropivacaine, can be used to induce spinal anesthesia with varying durations. Among these drugs, bupivacaine is the preferred choice for infraumbilical and lower limb surgeries because it provides both sensory and motor blockade for the patient's well-being and surgeon's convenience. In addition, it provides pain relief during the initial postoperative period. However, the duration of analgesia is insufficient to provide substantial pain relief in the postoperative period after the local anesthetic effect has worn off. Therefore, anesthetic techniques should be designed to provide residual analgesia in the immediate postoperative period.

Various animal studies have been conducted on rats, rabbits, dogs, and sheep, administering intrathecal dexmedetomidine at doses ranging from 2.5 to 100 µg without reported instances of neurological deficits. In human studies, epidural dexmedetomidine has also been administered without documented neurological deficits (27, 28). Furthermore, intrathecal dexmedetomidine combined with bupivacaine has been investigated in human subjects without postoperative neurological deficits (7, 8, 9).

Demographic data: The study included patients aged 18–60 years. The average age of those in group C was 41.83 ± 9.02 years, while group D's average age was 39.83 ± 10.40 years. The distribution of patients based on age was found to be statistically insignificant (p>0.05) and comparable between the two groups.

Patients in both groups had a mean height of > 150 cm. The average height for group C was 160.13 ± 4.48 cm, while group D's average height was 159.1 ± 3.48 cm. The distribution of patients based on their height was also found to be statistically insignificant (p>0.05) and comparable between the two groups.

The mean weight of the patients in group C was 55.9 ± 7.31 kg, while that of group D was 51.56 ± 4.94 kg. The distribution of patients based on weight was comparable between the two groups.

Therefore, the distribution of patients based on age, height, and weight was comparable and not statistically significant (p>0.05).

A previous study by Gupta et al. (13), and Al-Ghanem et al. (7), J. Bogra et al. (12), Al Mustafa et al. (8), Hala Eid et al. (11), and Ashraf et al. (15) and Kanazi et al. (9) Fauzia Khan et al. (1), R. Jamliya et al. (16), and P. Motiani et al. (10) also found that all patients were comparable with respect to age, height, and weight. Therefore, our study's results align with those of previous studies.

The distribution of patients according to ASA grading was comparable and not statistically significant (p>0.05), as demonstrated in studies conducted by Rajni Gupta et al. (13) and Al-Ghanem et al. (7), J. Bogra et al. (12), Al Mustafa et al. (8), Ashraf et al. (15), and Kanazi et al. (9), R. Jamliya et al. (16), and P. Motiani et al. (10). These studies also showed that all patients were comparable in terms of their distribution according to ASA grading. Therefore, the results of our study are consistent with those of the previous studies.

The duration of sensory block was determined by measuring the interval from drug administration in the subarachnoid space to the complete disappearance of the sensation to pinprick at the L1 dermatome level. The sensory block assessed in this study was established using a previously employed pin-prick method (13). Hocking et al.. demonstrated the reliability and practicality of this technique (49).

The present study observed the subjective sensations of tingling and warmth in the lower limbs within one minute in all patients. The mean time for the onset of sensory block was significantly longer in group C (151.66 ± 15.33 s) than in group D (128.66 ± 11.36 s) (p<0.001).

J. Bogra et al (12) reported similar results in terms of the onset of sensory block, as determined by the loss of pinprick sensation, between dexmedetomidine 5 µg added to 3 ml of 0.75% isobaric ropivacaine (4.8 ± 1.2 minutes) and plain ropivacaine (4.7 ± 1.1 minutes) in patients undergoing lower limb surgeries. However, the findings of the present study do not align with those of the aforementioned study with regard to onset time. It is possible that the faster onset of sensory block observed in the current study was due to the use of hyperbaric bupivacaine as opposed to isobaric ropivacaine in the aforementioned study.

This study aimed to calculate the time required to achieve the maximum sensory block. In our study, 28 of 31 patients in the dexmedetomidine group achieved the highest level of sensory block within 9 min, while only 3 of 15 patients in the control group achieved this within the same time frame. It is noteworthy that more patients in the control group needed more time to reach the highest level of sensory block than those in the dexmedetomidine group. The mean time to achieve the maximum sensory block in the control group was 9.41 ± 0.56 minutes, which was significantly longer (p < 0.001) than the dexmedetomidine group's mean time of 7.33 ± 0.73 minutes.

Previous studies have also shown that the addition of dexmedetomidine to bupivacaine can result in a shorter time to achieve the maximum sensory block; however, the reason for the differences in our results compared to other studies is unclear and may be attributed to methodological differences, such as differences in drug dosage, baricity, or total volume of drug used.

The study found that in group D, the highest sensory level achieved was T5-T6 in the maximum number of patients, which was 28. In contrast, the highest sensory level achieved in Group C was T6-T7 in 20 patients. The mean sensory level achieved in group C (6.8 ± 1.09) was statistically significant compared to that in group D (5.96 ± 0.67).

The highest cephalad spread of the sensory block was similar between dexmedetomidine and fentanyl at varying concentrations; however, the values were found to be statistically insignificant in the studies conducted by Gupta et al. (13) and Al-Ghanem et al. (7).

As shown in Table 6 and Graph No. 6, 83.3%) in group D experienced motor analgesia within 150 s of injection, whereas 93.3% of the patients in group C required more than 150 s to achieve motor analgesia. The time required for the onset of motor block when dexmedetomidine is administered intrathecally along with bupivacaine has not been previously reported, but Kanazi et al (9) noted a more rapid onset of motor block when dexmedetomidine was combined with bupivacaine compared to bupivacaine used alone.

The time to Achieve Complete Motor Blockade (Refer to Table 7 and Graph No. 7): Both groups achieved grade III motor blockade, with 26 out of 30 patients in group D (86.7%) achieving the maximum motor block level within 7 min, while only one patient (3.3%) in group C achieved this within the same time frame. The remaining 27 patients (90%) in group C achieved the maximum motor block level within 9 minutes. The mean time to achieve maximum motor block in group C was 8.6 ± 0.57 minutes, which was significantly longer than the mean time in group D, which was 6.67 ± 0.63 minutes. In contrast to previous studies, our investigation showed that the time required to achieve complete motor block was shorter. The reasons for the discrepancies in the results are unclear, but they may be related to differences in methodology, such as variations in drug dosage or baricity or subjective differences in the interpretation of the results..

The time taken for the sensory level to regress to two segments below its highest point was defined as the two-segment regression of the sensory block. In 28 (93.3%) patients from group C and 23 (76.7%) patients from group D, two-segment regression was achieved within 105 and 150 min, respectively. Our study's results showed that the mean time to achieve two-segment regression of the sensory level in group C (92.83 ± 8.37 min) was significantly shorter ($p<0.05$) than that in group D (146.83 ± 9.14 min). Additionally, the mean time to achieve two-segment regression of the sensory level in group D was significantly longer than that in group C.

Several previous studies have also demonstrated a significantly longer duration of two-segment regression with dexmedetomidine, including that reported by Hala et al. (11). Bogra et al (12), Kanazi et al (9), and Ji kim et al (17). The findings of our study are consistent with those of previous studies, showing that dexmedetomidine significantly prolongs the time for two-segment regression compared to bupivacaine.

The time of regression to T12 (Table 9 and Graph No. 9) The timeframe for the sensory level to regress from its highest point to the T12 dermatome level was defined as the variable of interest. In a sample of 30 patients from group C, 3 of 10 patients from group D showed regression to T12 within 180 min. The mean time to achieve sensory regression to T12 level in group C was 139.5 ± 13.60 minutes, which was shorter than the mean time in group D, which was 208.116 ± 16.21 minutes. The difference between the two groups was statistically significant ($p < 0.001$).

Notably, no authors have commented on the time required for sensory regression to the T12 level when dexmedetomidine is administered intrathecally along with bupivacaine. However, many authors have reported a prolonged time to regression to S1 or S2 when dexmedetomidine is added to bupivacaine.

Based on our findings, we can conclude that dexmedetomidine (Group D) had a longer duration of sensory block than bupivacaine (Group C).

The total duration of motor blockade (Table 10) In both groups C and D, complete recovery from motor blockade was observed. In group C, all 30 patients showed full recovery within 210 min, whereas in group D, 21 out of 27 patients achieved full recovery within 270 min. The average time for complete motor block recovery in group C was 179.16 ± 14.62 minutes, while in group D it was 265.66 ± 19.24 minutes. The results showed that group C achieved full recovery more rapidly than group D, and this difference was highly significant ($p<0.001$). Additionally, group D required more time to recover than group C, which was statistically significant ($p<0.001$). Previous studies conducted by M. Mustafa et al (8) and Hala et al (11) showed that the duration of complete motor block was significantly longer in dexmedetomidine compared to bupivacaine.

According to Kanazi et al. (9), the duration of complete motor block was significantly prolonged in the dexmedetomidine group (250 ± 76 min) compared to that in the bupivacaine group (163 ± 47 min). Similarly, B. Maharani et al (18) found that the duration of complete motor block was significantly prolonged in the dexmedetomidine group. These findings align with our study, which also demonstrated that the duration of complete motor block was significantly prolonged in the dexmedetomidine group compared to the bupivacaine group..

Total duration of complete analgesia: (Refer Table 11): The total duration of analgesia was determined as the time between the intrathecal administration of the local anesthetic and the onset of tolerable pain (VAS ≥ 0) at rest. The mean duration of analgesia in group C was 187.5 ± 15.07 minutes, for group F was 234 ± 16.31 minutes, and for group D was 301 ± 25.77 minutes. Statistically significant differences were observed in the mean duration of analgesia among the three groups ($p<0.001$). Additionally, the duration of analgesia was found to be statistically significantly longer in group D than in group C ($P<0.001$).

Time of Rescue Analgesia (Table 12):Rescue analgesia time was determined as the period from intrathecal injection to attaining a VAS score of 4 or higher at rest, necessitating additional analgesia in the form of an intramuscular diclofenac sodium injection at a dose of 1.5 mg/kg. The mean rescue analgesia duration in group C was 228.16 ± 17.54 minutes, while group D had a mean duration of 358 ± 32.63 minutes. The difference in the mean time of rescue analgesia between the groups was statistically significant ($p<0.001$), with group D having a longer duration than group C ($p<0.001$). Previous studies have reported the duration of effective analgesia, which is the time required for rescue analgesia. Studies by P. Motiani et al (10), Rajni Gupta et al (13), B. Maharani et al (18), and J. Bogra et al. (12) showed that the duration of rescue analgesia was significantly prolonged in various groups compared to that in the control groups. Ashraf et al (15) also found that dexmedetomidine significantly prolonged the time of first rescue analgesia in patients undergoing major abdominal surgeries.

Mean Pain scores (Table 13): Comparison of the mean VAS scores between the two groups showed no significant differences preoperatively or up to 120 min after the administration of the spinal drug. Despite the shorter duration of analgesia with bupivacaine, the quality of anesthesia was similar in both the groups. At 180 and 240 min, there was a slight increase in VAS score in Group C compared to Group D, but this was not statistically significant. However, at 480 min, the VAS score in Group C was significantly higher than that in Group D, likely because of the shorter duration of analgesia with bupivacaine. At 360 min, the VAS score in Group D was significantly higher than that in Group C. Both groups experienced comparable VAS scores at 12 and 24 h postoperatively, indicating a good quality of analgesia in both groups. Overall, the 24-hour VAS score was lower in the dexmedetomidine group with prolonged postoperative analgesia compared to bupivacaine.

The research by J. Bogra et al. (12) and Hala Eid et al. (11) showed that the pain scores were lower in the dexmedetomidine group than in the ropivacaine and hyperbaric bupivacaine groups, respectively, up to 24 h postoperatively. Additionally, Ashraf et al. (15) found that the VAS score was significantly lower in the dexmedetomidine group than in the 0.5% bupivacaine group over 24 h. These findings support the results of our study, which demonstrated that the overall VAS scores were significantly lower in the dexmedetomidine group than in the bupivacaine group, with improved quality of analgesia. These results

were statistically significant, confirming the importance of dexmedetomidine as an effective analgesic agent.

CONCLUSION

After conducting a clinical study comparing intrathecal dexmedetomidine (5 µg) as an adjuvant to 0.5% (15 mg) hyperbaric bupivacaine with 0.5% (15 mg) hyperbaric bupivacaine in infraumbilical surgeries, the following conclusions were drawn: dexmedetomidine resulted in a faster onset of sensory and motor blockade than bupivacaine, prolonged the duration of sensory and motor blocks and analgesia, and required less postoperative analgesic medication while maintaining an excellent quality of analgesia, with no significant changes in hemodynamic parameters or adverse events reported.

REFERENCES:

1. Fauzia A. Khan, Gauhar A. Hamdani. Comparison of Intrathecal Fentanyl and Buprenorphine in Urological Surgery. J Pak Med Asso 2006; 56 (6): 277-81.
2. Calatayud J, González A. History of the development and evolution of local anesthesia since the Coca Leaf. Anaesthesiology 2003; 98:1503–1508.
3. Harada Y, Nishioka K, Kitahata LM. Visceral antinociceptive effects of spinal clonidine combined with morphine, (D - Pen2, D - Pen5) enkephalin, or U50,488H. Anaesthesiology 1995; 83(2): 344-352.
4. Bajwa SJS, Kaur J, Singh G et al. Dexmedetomidine and clonidine in epidural anaesthesia. Indian J Anaesth. 2011; 55(2): 116-121.
5. Biswas BN, Rudra A, Bose BK, Nath S, Chakrabarty S. Intrathecal fentanyl with hyperbaric bupivacaine improves analgesia during caesarean delivery and in early postoperative period. Indian J Anaesth 2002; 46(6): 469-472.
6. Rathmell JP, Lair TR, Nauman B. The role of intrathecal drugs in the treatment of acute pain. Anaesth Analg 2005; 101: S30-S43.
7. Al-Ghanem, S.M., I.M. Massad, M.M. Al-Mustafa, K.R. Al-Zaben and I.Y. Qudaisat et al. Effect of Adding Dexmedetomidine versus Fentanyl to Intrathecal Bupivacaine on Spinal Block Characteristics in Gynecological Procedures: A Double Blind Controlled Study. Am. J. Applied Sci. 2009; 6 (5):882-887
8. Al-Mustafa MM, Abu-Halaweh SA, Aloweidi AS, Murshidi MM, Ammari BA, Awwad ZM, et al. Effect of dexmedetomidine added to spinal bupivacaine for urological procedures. Saudi Med J. 2009; 30 (3): 365–370.
9. G. E. Kanazi, M.T. Aouad, S.I. Jabbour- Khoury, M.D. Al Jazzar, and M. M. Alameddine et al. Effect of low-dose dexmedetomidine or clonidine on the characteristics of bupivacaine spinal block. Acta Anesthesiol Scand 2006; 50 (2): 222-227.
10. Poonam Motiani, Sujata Chaudhary, Nitin Bahl, A.K.Sethi. Intrathecal Sufentanil versus Fentanyl for lower limb surgeries – A Randomized controlled trial. J Anaesthesiol Clin Pharmacol. 2010; 26(4): 507–513.
11. Hala E A Eid MD, Mohamed A Shafie MD, Hend Youssef MD. Dose-related prolongation of hyperbaric bupivacaine spinal anesthesia by dexmedetomidine. Ain Shams J Anesthesiology 2011; 4(2): 83-95.
12. Rajni Gupta, Jaishri Bogra, Reetu Verma, Monica Kohli, Jitendra Kumar Kushwaha, Sanjiv Kumar. Dexmedetomidine as an intrathecal adjuvant for postoperative analgesia. Indian J of Anaesth. 2011; 55(4): 347-351.
13. Rajni Gupta, Reetu Verma, Jaishri Bogra, Monica Kohli, Rajesh Raman, Jitendra Kumar Kushwaha. A Comparative study of intrathecal dexmedetomidine and fentanyl as adjuvants to Bupivacaine. J Anaesthesiol Clin Pharmacol 2011; 27(3): 339–343.
14. Deepika Shukla, Anil Verma, Apurva Agarwal et al. Comparative study of intrathecal dexmedetomidine with intrathecal magnesium sulphate used as adjuvants to bupivacaine. J Anaesthesiol Clin Pharmacol. 2011; 27(4): 495–499.
15. Ashraf Amin Mohamed, MD, Khaled Mohamed Fares, MD, and Sahar Abd- Elbaky Mohamed, MD. Efficacy of Intrathecally Administered Dexmedetomidine versus Dexmedetomidine with Fentanyl in Patients Undergoing Major Abdominal Cancer Surgery. Pain Physician 2012; 15 (4): 339-348.
16. Ramila H Jamliya, Varun Deshmukh, Rajesh C, Jyostana Maliwad et al.Effect Of Adding Dexmedetomidine In Intrathecal Bupivacaine Versus Intrathecal Bupivacaine Alone On Spinal Block Characteristics In Orthopaedic Lower Limb Procedures [A Comparative Study]. RJPBCS 2013; 4 (1): 1340
17. Ji Eun Kim, Na Young Kim, Hye Sun Lee, Hae Keum Kil. Effects of intrathecal Dexmedetomidine on low-dose Bupivacaine spinal anesthesia in elderly patients undergoing Transurethral Prostatectomy. Biol. Pharm. Bull. 2013; 36(6): 959- 965.
18. B. Maharani, M. Sathya Prakash, P. Kalaiah, N.C. Elango. Dexmedetomidine and Buprenorphine as adjuvant to spinal anaesthesia – A comparative study. Int J Cur Res Rev. 2013; 5 (11): 97-103
19. Collins. Textbook of Anesthesia, Regional and General. 3rd edition, page 1282.
20. Stoelting RK, Hiller SC. Pharmacology and Physiology in Anaesthetic Practice 4th edition.
21. Ronald D M, Lars I Eriksson, Lee A Miller's Anesthesia 7th edition.
22. Carpenter RL, Caplan RA, Brown DL et al. Incidence and risk factor for side effects of spinal anaesthesia. Anaesthesiology 1992; 76: 906-16.
23. Stoelting Robert K. Pharmacology and Physiology in Anaesthetic Practice. 3rd edition, Lippincott Raven, 1999: 158-179.
24. Camorcia, Michela, Capogna, Giorgio Columb, Malachy et al. Minimum Local Analgesic Doses of Ropivacaine, Levobupivacaine, and Bupivacaine for Intrathecal Labor Analgesia. Anesthesiology. 2005; 102 (3): 646-650.
25. Paranjpe JS. Dexmedetomidine: Expanding Role in Anesthesia. Medical Journal of Dr. D. Y. Patil University 2013; 6: 5-13.
26. Candiotti KA, Bergese SD, Bokesch PM et al. Monitored Anesthesia Care with Dexmedetomidine: A Prospective, Randomized, Double-blind, Multicenter Trial. Anesthesia & Analgesia 2010; 110: 47-56.
27. Farag E, Argalious M, Sessler DI et al. Use of α2-Agonists in Neuroanesthesia: An Overview. Ochsner Journal 2011; 11: 57-69.
28. Guo TZ, Buttermann AE, Jiang JY et al. Dexmedetomidine Injection into the Locus Ceruleus Produces Antinociception. Anesthesiology 1996; 84: 873-81.
29. Jaakola ML, Salonen M, Lehtinen R et al. The Role of Dexmedetomidine in Neuraxial Anesthesia and Analgesia. Medical Princples 2017; 26: 31-43.
30. Ebert TJ, Hall JE, Barney JA et al. The effects of increasing plasma concentrations of dexmedetomidine in humans. Anesthesiology 2000; 93: 382-94.