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Comparison of Dexmedetomidine Plus Bupivacaine Versus Bupivacaine Alone for Spinal Anesthesia in Patients Undergoing Abdominal Hysterectomy

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ABSTRACT

Objective: To determine the peri-operative analgesic efficacy and quality of block by adding Dexmedetomidine as an adjuvant to Bupivacaine for spinal anaesthesia in patients undergoing abdominal hysterectomy.

Study Design: Comparative cross-sectional Study.

Place and Duration of Study: Anesthesia Department, Nishtar Hospital, Multan Pakistan, Jan to Jun 2019.

Methodology: A total of 100 women aged 30-65 years, who were planned for abdominal hysterectomy due to benign causes, and having ASA) status I-II were included. The patients were divided into two equal groups. In Group-B, 12.5mg of 0.5% hyperbaric diluted in 3ml normal saline was administered for induction of spinal anaesthesia. In contrast, in Group-B+D, 10µg Dexmedetomidine and 12.5mg 0.5% hyperbaric Bupivacaine diluted in 3ml normal saline were given. Time of sensory and motor block onset, total duration of the block, and analgesia were noted.

Results: The mean time of sensory and motor onset was significantly lower in the Group-B+D. The total duration of sensory block was 181.6±31.6 minutes in Group-B versus 345.2±23.5 minutes in Group-B+D (*p*-value <0.001). The total duration of the motor block was 142.9±8.6mins in Group-B versus 314.2±8.9mins in Group-B+D (*p*-value <0.001). Total analgesia duration was 129.4±8.3mins in Group- B versus 263.8±13.7mins in Group-B+D (*p*-value <0.001). A total of 2.54±0.35mg of rescue analgesia were required in Group- B versus 1.42±0.51mg in Group-B+D (*p*-value <0.001).

Conclusion: The use of Dexmedetomidine as an adjuvant to Bupivacaine for spinal anaesthesia shortens the onset and prolongs the duration of sensory and motor block and the total duration of analgesia.

Keywords: Analgesia, Dexmedetomidine, Spinal Anesthesia.

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INTRODUCTION

Spinal anaesthesia (SA) is the preferred choice in surgical interventions below the umbilicus. It blunts the responses of general anaesthesia and reduces the fear of surgery.[1,2] Blood loss and risk of thromboembolism are reduced to much extent. Moreover, the onset is rapid, and there is little risk of failure. The major shortcomings of spinal anaesthesia (SA) are its shorter duration and its role in post-operative pain control.[3,4]

Abdominal hysterectomy is the second most common surgical operation in gynecological practice.[5] The major concern of abdominal hysterectomy is the post-operative pain, which not only slows the recovery after hysterectomy but also prolongs the hospital stay and, in some cases, can lead to chronic pain. Pain has also effects on multiple systems of the body which includes cardiovascular effect (e.g. hypertension, tachycardia, enhanced myocardial irritability, and increased systemic vascular resistance).[6]

Bupivacaine is the most commonly used local anaesthetic for subarachnoid SAB, as it has a longer duration of action and lower risk of adverse effects.[7] Local anaesthetics work primarily by causing blockade of voltage-gated sodium channels in the axonal membrane and possibly, a further effect on pre-synaptic inhibition of calcium channels.[8]

In recent years, the use of α2-receptor agonists such as clonidine and Dexmedetomidine has gained popularity in spinal anaesthesia to control chronic pain and peri-operative analgesia.[8,9] Dexmedetomidine has a ten times higher affinity for α2-receptors than that clonidine, due to which it is a more effective analgesic and sedative than that clonidine.[10]

Conflicting literature is there regarding the efficacy of Dexmedetomidine for procedures associated with severe post-operative pain, such as abdominal hysterectomy, so the present study is conducted to determine the efficacy of Dexmedetomidine as an

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adjuvant to Bupivacaine for patients undergoing abdominal hysterectomy under spinal anaesthesia.

METHODOLOGY

This comparative cross-sectional study was conducted at the Nishtar Hospital, Multan Pakistan, from January to June 2019. Ethical approval was taken from the Hospital IRB Committee (IRB; 26880-935)

Inclusion Criteria: Women aged 30-65 years, who were planned for abdominal hysterectomy due to benign causes, having ASA status I-II, were included in the study.

Exclusion Criteria: Women who were found allergic to the study drugs, and who were taking analgesics or on anti-coagulant therapy were excluded from the study.

The day before surgery, a pre-anaesthesia evaluation was done on all patients. In addition, every patient was explained the visual analogue scale (VAS) scale (0-10 score) pre-operatively to express the pain intensity in the post-operative period. We used the VAS scale because it is easy to understand, and even illiterate people can understand and use it.

The patients were divided into two equal groups using a computer-generated random numbers table. In Group-B, 12.5mg of 0.5% hyperbaric Bupivacaine diluted in 3ml normal saline was administrated for induction of spinal anaesthesia, while in Group-B+D, 10µg Dexmedetomidine along with 12.5mg 0.5% hyperbaric Bupivacaine diluted in 3ml normal saline was administered. An anesthetist who was unaware of the study groups administered anaesthesia to the patients.

A 27 Gauge Quincke needle was inserted between the L3 and L4 intervertebral spaces for spinal anaesthesia. After administering drugs, the patient was asked to lie in the supine position, and O2 was administrated for 3minutes at a rate of 3L/min using an O^2 mask.

The time of onset of sensory and motor block and the total duration of the block was noted for each patient.

The onset of sensory block was defined as loss of sensation to pin-prick in the midline, determining the onset time by the loss of pin-prick sensation to a 27G blunt needle pricked at 1-minute intervals until the patient reported no sensation. Then the needle was pricked after every 5 minutes to determine the total duration of the sensory block.

The motor block was assessed using the modified Bromage scale, and the motor reflex was initially determined after every 2 minutes to determine the block's onset. After that, the reflexes were evaluated every 15 minutes to determine the total time of the motor block, the return of knee reflex back to the O-modified Bromage scale was noted, and the total duration of the motor block was calculated. Modified Bromage Scale is: Grade-0: The patient can move the hip, knee and ankle, Grade-1: The patient cannot move the hip but can move the knee and ankle, Grade-2: The patient cannot move the hip and knee but can move the ankle, Grade-3: Patient is unable to move the hip, knee and ankle.[11]

VAS score was noted at different time intervals till 24 hours after surgery. When the pain score became >3, Inj. Tramadol (50 mg bolus) was given as rescue analgesia. Total analgesia duration and total doses of rescue injection tramadol were noted. The pain visual analogue scale (VAS) is comprised of a horizontal visual analogue scale (HVAS) or vertical visual analogue scale (VVAS) line, usually, 10 centimetres (100mm) in length, anchored by two verbal descriptors, one for each symptom extreme. Instructions, periods for reporting and verbal descriptor anchors have varied widely in the literature depending on the intended use scale.

Statistical Package for Social Sciences (SPSS) version 25.0 was used for the data analysis. Continuous variables were compared using the independent sample t-test. While comparison of qualitative variables was made using the chi-square test. The *p*-value ≤0.05 was taken as a cut-off to determine a significant difference.

RESULTS

There were 100 patients included in the study, with the mean age of 46.9±7.1years. In Group-B, 39(78%) patients had ASA I, and 11(22%) had ASA II, while in Group-B+D, 41(82%) patients had ASA I, and 9(18%) had ASA II. There was no difference in the duration of surgery; 82.5±13.1 minutes in Group-B versus 85.8±10.9 minutes in Group-B+D (*p*-value 0.17) (Table-I).

Table-I: Baseline Characteristics (n=100)

Characteristics	Group-B (n=50)	Group-B+D (n=50)	*p*-value
Age (Year)	46.9±7.1	47.2±6.9	0.83
Weight (Kg)	64.7±11.3	65.5±12.9	0.74
American Society of Anesthesiologists (ASA) Scale I	39 (78%)	41 (82%)	0.61
American Society of Anesthesiologists (ASA) scale II	11 (22%)	9 (18%)	
Duration of Surgery	82.5±13.1	85.8±10.9	0.17

Major hysterectomy indication was uterine fibroids and heavy menstrual bleeding HMB, and there was no difference in hysterectomy indications between the groups (Table-II).

Table-II: Indications of Hysterectomy(n=100)

Indications	Group-B (n=50)	Group-B+D (n=50)	*p*-value
Uterine Fibroids	23 (46%)	26 (52%)	0.93
Heavy Menstrual Bleeding	15 (30%)	14 (28%)	
Adenomyosis	4 (8%)	3 (6%)	
Pre-menstrual bleeding	8 (16%)	7 (14%)	

There were significant differences in study outcomes between the groups. The mean time of sensory onset was 11.7±1.19 mins. in Group-B versus 6.3±0.81 mins in Group-B+D (*p*-value <0.001). The total duration of sensory block was 181.6±31.6 mins in Group-B versus 345.2±23.5 in Group-B+D (*p*-value <0.001). The mean onset time of the motor block was 18.4±3.8 mins in Group-B versus 8.9±1.3 mins in Group-B+D (*p*-value <0.001). The mean duration of the motor block was 142.9±8.6 mins in Group-B versus 314.2±8.9 in Group-B+D (*p*-value <0.001). Total anal-gesia duration was 129.4±8.3 mins in Group-B versus 263.8±13.7 mins in Group-B+D (*p*-value <0.0001). A total of 2.54±0.35 doses of rescue analgesia were required in Group-B 1.42±0.51 in Group-B+D (*p*-value <0.001) (Table-III).

Table-III: Comparison of Block Characteristics (n=100)

Block Characteristics	Group-B (n=50)	Group-B+D (n=50)	*p*-value
Onset of Sensory Block (min)	11.7±1.19	6.30±0.81	<0.001
Total Duration of Sensory Block (min)	181.6±31.6	345.20±23.50	<0.001
Onset of Motor Block (min)	18.40±3.80	8.90±1.30	<0.001
Total Duration of Motor Block (min)	142.90±8.60	314.20±8.90	<0.001
Total duration of Analgesia (min)	129.40±8.30	263.80±13.70	<0.001
Total rescue Analgesia doses	2.540±0.35	1.42±0.51	<0.001

The mean visual analogue scale VAS score was lower at various time intervals in Group-B+D compared to Group-B. A detailed VAS score was depicted in Figure.

DISCUSSION

The efficacy of Dexmedetomidine is well-proven for procedures with less post-operative pain, such as urological procedures, cesarean-section and minor surgeries involving the lower limb.[11,12] Hysterectomy is performed using abdominal, vaginal, open and laparoscopic approaches.[13] To date, more than 60% of hysterectomy procedures are performed using the abdominal route.[14] Spinal anaesthesia is the preferred choice of gynaecologists to perform surgical proce-dures as it is cost-effective and associated with mini-mum morbidity and mortality. Other advantages of spinal anaesthesia include less exposure to potentially depressant drugs of general anaesthesia, decreased risk of pulmonary aspiration, patient remaining awake during the surgery, and the options of using adjuvants for post-operative pain relief.

Figure: Visual Analog Scale (VAS) Pain Score at different Time Intervals

Chatrath *et al.* determined the efficacy of Dexmedetomidine in patients undergoing infra-umbilical surgeries and reported that the addition of Dexmedetomidine significantly shortens the onset time of sensory (18.26±1.01 min in Group B vs 7.94±0.712 min in Group B+D) and motor block (19.10±2.94 min in Group B vs 9.88±0.71 min in Group B+D), enhances the duration of sensory (177.74±28.57 min in Group B vs 353.36±12.13 min in Group B+D) and motor block (146.94±9.71 min in Group-B vs 318.36±9.374 min in Group B+D) and prolongs the analgesia duration (126.34±7.684 min in Group-B vs 283.96±11.165 min in Group B+D).[15]

Another study by Khan *et al*. reported that the addition of Dexmedetomidine along with Bupivacaine is beneficial in terms of quicker onset and prolonged duration of analgesia.[16] However, these authors used 5µg Dexmedetomidine, and in the present study, we used 10µg Dexmedetomidine as an adjuvant. Other studies have also reported similar results.[17,18]

A recent meta-analysis by Liu *et al*. containing 25 randomized trials (1478 patients) on the quality and duration of spinal anaesthesia reported that Dexmede-

tomidine addition significantly prolongs the duration of analgesia compared to the placebo group.[19]

In short, the present study and other published studies have concluded that the addition of Dexmedetomidine is highly effective for inducing spinal anaesthesia. However, studies have used different doses of Dexmedetomidine as an adjuvant to Bupivacaine. Therefore, there is a need to conduct dose trials of Dexmedetomidine to determine the minimal effective dose in spinal anaesthesia.

CONCLUSION

The use of Dexmedetomidine as an adjuvant to Bupivacaine for spinal anaesthesia shortens the onset and prolongs the duration of sensory and motor block and the total duration of analgesia.

Conflict of Interest: None.

Author's Contribution

Following authors have made substantial contributions to the manuscript as under:

MSA & SAH: Conception, Study design, drafting the manuscript, approval of the final version to be published.

AA & AS: Data analysis, data interpretation, critical review, approval of the final version to be published.

MSS & UK: Data acquisition, critical review, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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