Comparison between Two Different Doses of Intrathecal Dexamethasone Added to Bupivacaine for Post-operative Analgesia in Patients Undergoing Abdominal Hysterectomy

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ABSTRACT
Background: Insufficient surgical pain management can hinder healing, raise healthcare expenses, and decrease patient satisfaction. According to some investigations, spinal bupivacaine-dexamethasone showed analgesic effects that were nearly as potent as those of bupivacaine-fentanyl while also having opioid-sparing and antiemetic properties. The optimal spinal dexamethasone dosage for postoperative analgesia has not yet been established. It was therefore required to conduct a study looking at the effectiveness and safe amount of spinal dexamethasone for postoperative analgesia in patients having abdominal hysterectomy. **Aim:** Optimizing post-operative analgesia using two different doses of intrathecal dexamethasone added to bupivacaine in patients undergoing abdominal hysterectomy.
Patients and methods: This study was conducted on patients who underwent elective abdominal hysterectomy at Zagazig University Hospitals' Department of Anaesthesia, Intensive Care, and Pain Management. The patients were divided into 3 groups (43 subjects each): Group C (Control group) received intrathecal bupivacaine 0.5% 4 cc plus 1 cc normal saline, group D2: received intrathecal bupivacaine 0.5% 4 cc plus 2 mg dexamethasone in 1cc volume and group D4 received intrathecal bupivacaine 0.5% 4 cc plus 4 mg dexamethasone in 1cc volume.
Results: In terms of post-operative discomfort, there were statistically significant differences between groups C and D4 at various follow-up intervals. Also, between groups D2 and D4 from 0 to 12 hours after surgery.
Conclusion: In women having abdominal hysterectomy surgery, intrathecal dexamethasone 4 mg combined with bupivacaine increased the intensity and duration of post-operative analgesia without causing any negative side effects.
Keywords: Abdominal hysterectomy, Intrathecal dexamethasone, Bupivacaine.

INTRODUCTION

One of the most frequent gynecological procedures carried out globally is the abdominal hysterectomy. Hysterectomy complications can vary depending on the surgical approach and method. The hormonal balance and general health of patients are impacted by hysterectomy, which offers benefits and hazards [1]. 80% of surgical patients experience post-operative pain, the most common type is acute pain. The frequency and severity of pain closely correlates with the length of time after surgery, with the former being greater in the initial days following surgery due to its complex physiological reaction of autonomic and behavioral response to tissue injury [2].

A high-potency, long-acting glucocorticoid called dexamethasone has been used to stop post-operative nausea. It doesn't have a mineralocorticoid effect. Single doses of dexamethasone or other glucocorticoids have also been reported to improve analgesia after a number of surgical procedures [3].

Dexamethasone reduces inflammation, blocks the transmission of nociceptive C-fibers, and suppresses ectopic neural discharge. The ideal dosing regimen is still unknown. Doses ranging from 1 mg to 10 mg were used in various coaxial and peripheral nerve blocks. Some editorials suggested removing studies examining perineural dexamethasone at doses of 8 mg and higher.

High doses of dexamethasone have not consistently been shown to be more effective in studies [4].

Hyperglycemia, blood pressure abnormalities, edema, gastrointestinal bleeding, and more significant complications like psychological issues, delayed wound healing, higher risk of infection, and electrolyte disorders like hypokalemia or hyperkalemia are among the short-term adverse effects [5].

Intrathecal dexamethasone enhances the duration of the pain-free period and greatly lengthens the duration of the sensory block (without delaying the onset time) [6].

SUBJECTS AND METHODS

In the Department of Anaesthesia, Intensive Care, and Pain Management, Zagazig University Hospitals, a comparative prospective randomized double-blind controlled clinical trial was carried out with patients who had undergone an elective abdominal hysterectomy during the previous six months.

Inclusion criteria: Participants in the study ranged in age from 21 to 65 and had undergone elective hysterectomy, ASA [I, II] and body mass index (BMI) from 25 to 30 kg/m^2.

Exclusion criteria: Patients with systemic conditions that could skew the results of the study, such as diabetes mellitus, severe coronary insufficiency and/or myocardial infarction, severe renal or hepatic disorders, those who were receiving steroid medication. Patients with bleeding disorders, local infections, severe valvular heart disease, contraindications to steroids, allergies to drugs used in the study, and patients with failed spinal.

Preoperative:

All the patients underwent full history taking and full clinical examination for all systems, routine laboratory investigations. Using computer-generated randomizing tables, the patients were divided into three equal groups.:

✓ Control group (C = 43) who received intrathecal bupivacaine 0.5% 4 cc plus 1 cc normal saline.

✓ Group D2 (43) received 2 mg of dexamethasone in a 1cc volume plus intrathecal bupivacaine 0.5% in 4 cc.

✓ Group D4 (43) received 0.5% bupivacaine intravenously in 4 cc and 4 mg of dexamethasone in 1 cc.

Intraoperative:

In the operation room, two venous cannula that had been prefilled with 500 ml of crystalloid were inserted. Every ten minutes throughout the procedure, vital signs were recorded on a standard monitor. Pulse oximetry, electrocardiography, and noninvasive blood pressure were all included in this monitor. A premedication of Fentanyl 0.05 mg/kg and 1 mcg/kg midazolam, as well as a nasal prong oxygen supply with a flow rate of 2-4 L/min, were attached. In order to provide an intrathecal injection in the L3-L4 intervertebral area, a 27 G pencil-point spinal needle was utilized in a midline approach after thoroughly cleaning the patient's back with povidone-iodine 10% and 70% alcohol while they were seated and using complete aseptic technique. After 2-4 ml of localized, 1% lidocaine infiltration into the skin and subcutaneous tissues, this was carried out. The spinal needle's introducer was then gently held, and the total of Heavy bupivacaine 0.5% in 4 ml was administered to the C group along with 1 ml of normal saline.

A total of 4 ml of heavy bupivacaine 0.5% and 1 ml of dexamethasone were administered to the D2 group and the D4 group received 4 ml of strong bupivacaine 0.5% and 2 ml of dexamethasone. A urinary catheter was then inserted once the patient was turned to lie flat. From the moment that medicines were injected into the intrathecal space to the peak (maximum dermatome level) of the sensory and motor block, a period of time known as the "onset time" was calculated.

The woman was asked about a location likely to be blocked on the same side of the body by placing a piece of cotton impregnated with alcohol on one that isn't likely to be the dermatome covered by the spinal block and asking how cold it feels to them. Then, use the piece of cotton impregnated with alcohol to ask, "Does this feel the same cold as your face/arm or different?" Apply the cotton piece soaked in alcohol to places above and below this point until it is clear at what level the top and bottom of the block are. A woman may argue that it feels colder, warmer, or the same. The procedure was repeated on both sides of the body, and until the appropriate level (T8–10 dermatome), the sensory block level was assisted every 2 minutes.

Prior to surgery, the patient's motor function was assessed using the Bromage scale (0–3), with a goal of reaching Bromage 3. If the patient can move their knee and ankle but not their hip in example 1, then they can move their ankle but not their hip in example 2, etc. 3. The patient's hip, knee, and ankle are immobile [7].

Every ten minutes, blood pressure and heart rate were measured. Hypotension more than 20% of basal blood pressure was treated by intravenous fluid bolus and ephedrine 5 mg intravenous in incremental doses and Atropine (0.01 mg/kg) was administered intravenously to treat any drop in heart rate below 60 beats per minute.

Post-operative:

The patients were moved from the operating room to the post-anesthesia care unit (PACU) following the procedure. As part of standard multimodal analgesia, they got 75 mg of diclofenac and 1 gm of paracetamol intravenously. Following surgery, 30 minutes were spent evaluating sensory and motor obstacles. While a motor block is measured from the time it first starts to the point at which lower limb muscles restore motor function, Bromage = 0, a sensory block is measured from the top of the block until the patient feels pain at the site of the surgery, VAS > 0. The updated Observer's Assessment of Alertness/Sedation Scale (OAA/S) was used to measure sedation. A score of 5 indicates an alert patient, a score of 4 indicates lethargic responses to names called in a normal tone, a score of 3 indicates that the patient only reacts when the name is called repeatedly loudly, a score of 2 indicates that the patient only responds after mild prodding or shaking, and a score of 1 indicates that the patient does not respond to mild prodding or shaking [8].

Pain was measured use a VAS (visual analogue scale). According to patient self-reporting, the VAS was measured with a 10 cm ruler at rest and during mobilization. The scale goes from 0 to 10, where 0 denotes no discomfort and 10 denotes extreme pain (the most excruciating anguish imaginable). The patient was advised to score zero if she felt no pain and 10 if the discomfort was the worst when using this technique. Pain was rated from zero to four as light, from four to six as moderate, and from seven to 10 as severe. If VAS was greater than 3, nalbuphine 10 mg intramuscular was given as a rescue analgesic. [9].

Ethical Approval:

All participants in the study provided their informed permission. Approval from Zagazig University's Department of Medicine's Institutional Review Board (IRB) was obtained. This work has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

Statistical Analysis

Utilizing the IBM SPSS software package, version 24.0, data were entered into the computer. It was done using the chi-square test, independent t-test, and F-test (ANOVA). P value less than 0.05 is significant.

RESULTS

Table (1) showed that age in group C ranged from 26-63 years with mean value of 46.07 ± 11.12, in group D2 ranged from 27-63 years with mean value of 44.93 ± 10.76 and in group D4 ranged from 28-65 years with mean value of 42.56 ± 11.79. There was no statistical significant difference between the three studied groups regarding age (P1, P2, and P3 > 0.05).

Table (1): Comparison between the three studied groups regarding age (years)

Age	Group C	Group D2	Group D4
Range	26-63	27-63	28-65
Mean	46.07	44.93	42.56
±SD	±11.12	±10.76	±11.79
p1	0.315 NS		
p2	0.079 NS		
p3	0.166 NS		

Table (2) showed that ASA I in group C was 29 (67.44%), and II was 14 (32.56%). In group D2 were 25 (58.14%) respectively and in group D4 were 22 (51.16%) and 21 (48.84%) respectively. There was no statistical significant difference between the three studied groups regarding ASA (P1, P2, and P3 > 0.05).

Table (2): Comparison between the three studied groups regarding ASA

ASA	Group C		Group D2		Group D4	
	No	%	No	%	No	%
I	29	67.44	25	58.14	22	51.16
II	14	32.56	18	41.86	21	48.84
p1	0.189 NS					
p2	0.064 NS					
p3	0.261 N.S.					

Figure (1) showed that there was no statistically significant difference between group C with group D2 and between group D2 with D4 at different periods of follow up (P1 & P3 > 0.05), while there was statistical significant

difference between group C and D4 from period 30 min I.O to 12 hr. postoperative (P2 < 0.05) regarding heart rate.
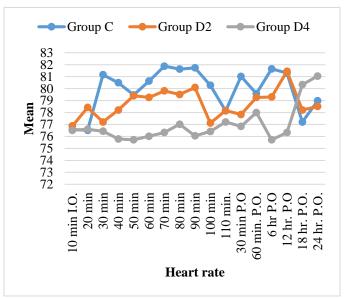

Figure (1): Comparison between the three studied groups regarding heart rate.

Figure (2) showed that there was no statistically significant difference between group C and group D2 at different periods of follow up (P1> 0.05). There was statistically significant difference between group C and D4 at all different periods of follow up (P2 < 0.05). There was statistically significant difference between group D2 and group D4 at periods from 10 min. I.O to 100 min I.O (P3 < 0.05) regarding mean blood pressure.
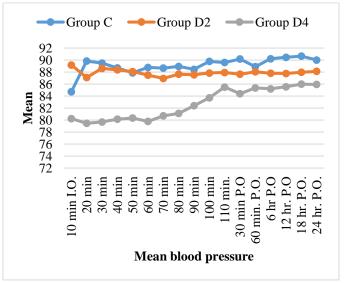

Figure (2): Comparison between the three studied groups regarding mean blood pressure

Figure (3) showed that sensory block duration time in group C ranged from 98-306 min with a mean value of 204.28 ± 53.90, in group D2 ranged from 100-454 min with a mean value of 270.56 ± 69.63 and in group D4

ranged from 112-468 min with a mean value of 273.40 ± 107.48. There was no statistically significant difference between group C and group D2 (P1 > 0.05), while there was statistically significant difference between group C and D4 and between group D2 and D4 regarding sensory block duration time (P2 & P3 < 0.05).
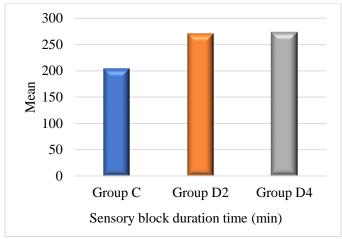

Figure (3): Comparison between the three studied groups regarding sensory block duration (min).

Figure (4) showed that motor block duration time in group C ranged from 96-346 min with a mean value of 197.49 ± 59.96, in group D2 ranged from 95-253 min with a mean value of 158.02 ± 44.14 and in group D4 ranged from 94-322 min with a mean value of 216.67 ± 43.91. There was statistically significant difference between the three studied groups regarding motor block duration time (P1, P2 & P3 < 0.05).
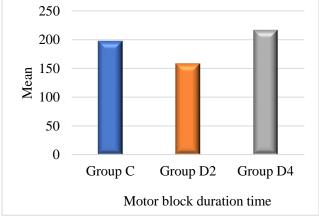

Figure (4): Comparison between the three studied groups regarding motor block duration time.

Table (3) showed that in group C, total opioid consumption in the first 24 hour ranged from 10-25 mg with a mean value of 15 ± 4.76, in group D2 ranged from 10-25 mg with a mean value of 14.19 ± 4.49 and in group D4 ranged from 5-15 mg with a mean value of 10.35 ± 3.16. There was statistically significant difference between group C and D4 and group D2 & D4 (P2 & P3 <

0.05). While, there was no statistically significant difference between group C and D2 (P1> 0.05) regarding total opioid consumption in the first 24hour.

Table (3): Comparison between the three studied groups regarding total opioid consumption in the first 24hour (mg)

Total opioid consumption in the first 24hour (mg)	Group C	Group D2	Group D4
Range	10-25	10-25	5-15
Mean	15.00	14.19	10.35
SD	4.76	4.49	3.16
P1	0.208		
P2	0.001		
P3	0.001		

P1 (comparison between group C and group D2),
P2 (comparison between group C and group D4)
P3 (comparison between group D2 and group D4)

Table (4) showed that in group C, time to first rescue analgesic dose ranged from 56-80 min with a mean value of 67.72 ± 7.02, in group D2 ranged from 56-80 min with a mean value of 69.44 ± 7.29 and in group D4 ranged from 156-240 min with a mean value of 193.07 ± 30.39. There was statistical significant difference between group C and D4 and group D2 and D4 (P2 & P3< 0.05). While there was no statistical significant difference between group C and D2 (P1> 0.05) regarding time to first rescue analgesic dose.

Table (4): Comparison between the three studied groups regarding time to first rescue analgesic dose (min)

Time to first rescue analgesic dose (min)	Group C	Group D2	Group D4
Range	56-80	56-80	156-240
Mean	67.72	69.44	193.07
SD	7.02	7.29	30.39
P1	0.134		
P2	0.001		
P3	0.001		

P1 (comparison between group C and group D2)
P2 (comparison between group C and group D4)
P3 (comparison between group D2 and group D4)

Table (5) showed that there was statistically significant difference between the three studied groups regarding hyperglycemia, shivering, malaise, nausea, vomiting, headache and hiccups (P< 0.05). While there was no statistical significant regarding hypotension and bradycardia (P > 0.05).

Table (5): Comparison between the three studied groups regarding complications

Complication	Hyperg-lycemia	Hypo-tension	Bradycardia	Shivering	Malaise	Nausea	Vomiting	Headache	Hiccups
Group C	20 (46.51)	13 (30.23)	15 (34.88)	16 (37.21)	14 (32.56)	14 (32.56)	15 (34.88)	14 (32.56)	14 (32.56)
Group D2	14 (32.56)	11 (25.58)	12 (27.91)	10 (23.26)	15 (34.88)	13 (30.23)	16 (37.21)	12 (27.91)	11 25.58
Group D4	9 (20.93)	13 (30.23)	10 (23.26)	8 (18.60)	11 (25.58)	8 (18.60)	8 (18.60)	9 (20.93)	5 (11.63)
X^2 **P value**	8.58 0.013*	2.11 0.107	2.09 0.133	8.25 0.018*	7.01 0.032*	14.52 0.008*	19.2 0.001*	7.85 0.011*	15.33 0.009*

Table (6) showed that there was statistically significant difference between the three studied groups regarding sedation score at 1hr P.O and before discharge from PACU (P < 0.05) while there was no statistically significant difference at 0 hr P.O. (P > 0.05).

Table (6): Comparison between the three studied groups regarding sedation score

Patients satisfaction	0 hr P.O		1 hr P.O		before discharge from PACU	
	No	%	No	%	No	%
Group C						
• Fully awake	0	0.00	0	0.00	12	27.91
• Drowsy with closed eye	0	0.00	15	34.88	13	30.23
• Easily aroused with light tactile stimulation or simple verbal command	13	30.23	12	27.91	18	41.86
• Arousable only by strong physical stimulation	17	39.53	16	37.21	0	0.00
• Unarousable	13	30.23	0	0.00	0	0.00
Group D2						
• Fully awake	0	0.00	0	0.00	12	27.91
• Drowsy with closed eye	0	0.00	16	37.21	15	34.88
• Easily aroused with light tactile stimulation or simple verbal command	11	25.58	12	27.91	16	37.21
• Arousable only by strong physical stimulation	16	37.21	15	34.88	0	0.00
• Unarousable	16	37.21	0	0.00	0	0.00
Group D4						
• Fully awake	0	0.00	0	0.00	12	27.91
• Drowsy with closed eye	0	0.00	9	20.93	15	34.88
• Easily aroused with light tactile stimulation or simple verbal command	17	39.53	8	18.60	16	37.21
• Arousable only by strong physical stimulation	17	39.53	14	32.56	0	0.00
• Unarousable	9	20.93	12	27.91	0	0.00
X^2 **P value**	2.65 0.102 NS		19.85 0.001*		10.5 0.013*	

DISCUSSION

Our findings demonstrated that the fundamental clinical variables, such as age and ASA, of the three study groups were matched without a discernible variation; this finding was crucial in removing the influence of demographic information on the outcome.

In comparison to the other two groups, group D4 was shown to have lower mean arterial blood pressure and heart rate values. Heart rate and mean arterial blood pressure varied because group D4 had a much lower pain score than the other two groups. According to the results of our investigation, group D4 exhibited much higher sensory and motor block than the control group. **Shalu et al.** [10] reported that sixty patients were randomly divided into two groups after spinal anesthesia, and given intravenous injections of 2 cc of sterile saline (control group) and 4 mg of dexamethasone (the intervention group). Additionally, all patients had a 10 mg spinal anesthetic injection of bupivacaine 0.5% strong. They showed that by giving dexamethasone intravenously at a dose of 8 mg, the duration of post-operative analgesia and sensory block following a cesarean section under spinal anesthesia may be prolonged. A few studies have looked at how dexamethasone and bupivacaine together can lengthen the time that local anesthesia lasts for individuals getting spinal anesthesia for cesarean sections. According to **Shalu et al.** [10] administering 8 mg of dexamethasone intravenously lengthens the time that post-operative analgesia and sensory nerve block last. According to **Sachdeva et al.** [11] the duration of the transversus abdominal plane (TAP) block was extended without any complications by combining 8 mg of dexamethasone with the bupivacaine.

According to the findings of our investigation, group D4 experienced much less post-operative discomfort than the control group and group D2. On the other hand, group D4 consumed much fewer total opioids within the first 24 hours (mg) than the control and D2 groups. Additionally, group D4 had a considerably longer duration to the first rescue analgesic dose (min) than the other two groups. **Taguchi et al.** [12] revealed that three patients with unremitting cancer pain had their pain score successfully reduced by intrathecal injection of betamethasone. According to a different study, laparoscopic cholecystectomy with dexamethasone (4 mg) lowers post-operative pain scores and morphine usage [13].

Dexamethasone's analgesic benefits, according to some writers, are the result of their systemic actions. Its local action on nerve fibers may be what causes the block to last longer. Previous studies showed that adding dexamethasone to local anesthetics lengthened the time that peripheral nerves were blocked. According to a study on supra-clavicular block, after a cesarean section under spinal anesthesia, the time that post-operative analgesia and sensory block last may be extended [14]. Dexamethasone, when combined with lidocaine, considerably lengthens the duration of analgesia without altering the onset, according to another study in axillary block [15].

Numerous studies indicated that the safest and most efficient form of multimodal analgesia appears to be intermediate dosages of corticosteroids, such as dexamethasone. Additionally, they demonstrated that when steroids are given preoperatively (at least one hour prior to surgery) or during anesthesia induction, analgesia is increased. In the first 24 hours following surgery, dexamethasone is a multimodal strategy for managing post-operative pain that lowers pain scores and the requirement for rescue analgesia. The results of our investigation were similar to this. [13].

Since group D4 had a much lower incidence of complications than the other two groups, group D4's patient satisfaction was also significantly greater. The sedation score finally registered as negligible. **Chen et al.** [16] reported that because we did not use opioid in the rescue analgesia, our findings' low prevalence of post-operative nausea and vomiting (POVN) may be explained. A meta-analysis found that the incidence of POVN was 72% lower with dexamethasone with TAP block than with local anesthetics alone [16, 17].

CONCLUSION

The post-operative pain scores were lower in the dexamethasone group getting a dose of 4 mg, despite the incidence of side effects being similar to the group receiving a dose of 2 mg and also lower than the control group. Intrathecal dexamethasone 4 mg plus bupivacaine enhanced the intensity and duration of post-operative analgesia in women undergoing abdominal hysterectomy surgery without producing any adverse side effects.

Conflicts of interest: The writers claimed that there were not any conflicts of interest.

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