Effect of Two Different Doses of Intrathecal Dexamethasone Added to Bupivacaine on Post-Operative Pain in Patients Undergoing Abdominal Hysterectomy

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Abstract:

Background: Inadequate postoperative pain relief can delay recovery, increase healthcare costs and reduce patient satisfaction. Some studies revealed that spinal bupivacaine-dexamethasone had almost the same analgesic potency as bupivacaine-fentanyl with opioid-sparing and antiemetic effects. The optimumdose of spinal dexamethasone for postoperative analgesia has not been yet evaluated. So, it became mandatory to conduct a study clearing the safety and the optimum dose of spinal dexamethasone for postoperative analgesia in patients undergoing 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 atDepartment of Anaesthesia, Intensive Care and Pain Management, Zagazig University Hospitals on patients who were undergo elective abdominal hysterectomy. The patients were divided into group (C: Control group who were received intrathecal Bupivacaine 0.5% 4cc plus 1cc normal saline, group (D2): who were received intrathecal Bupivacaine 0.5% 4cc plus 2 mg dexamethasone in 1cc volume and group (D4) n= 43: who were received intrathecal Bupivacaine 0.5% 4cc plus 4mg dexamethasone in 1cc volume.

Results: There was statistically significant difference between group C with D4 at different periods of follow up and there was statistically significant difference between group D2 with D4 from period 0 hr. to 12 hr P.O regarding post-operative pain.

Conclusion: Intrathecal dexamethasone 4 mg in combination with a Bupivacaine augmented the intensity and duration of post-operative analgesia without adverse effects in women undergoing abdominal hysterectomy surgery.

Keywords: Intrathecal Dexamethasone, Bupivacaine, Abdominal Hysterectomy.

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Introduction:

Abdominal hysterectomy is one of the most common gynecologic procedures performed all over the world. Complications of hysterectomy vary based on the route of surgery and surgical technique.Hysterectomy has risks and benefits and affects the hormonal balance and overall health of patients **(1).**Effective post-operative pain control is an essential component of the care of the surgical patient. Inadequate pain control may result in increased morbidity or mortality **(2).**Epidural and intrathecal steroids are used to reduce chronic pain **(3).** In some studies, intrathecal dexamethasone increased duration of sensory block and post-operative analgesia **(4).**Although intrathecal dexamethasone is used to control chronic pain; few studies have been conducted on the effects of sensory block and post-operative pain in patients undergoing surgery **(4).**Dexamethasone is an effective adjuvant for prolonging peripheral nerve block duration with minimal side effects. Block can be prolonged by perineural or intravenous administration of dexamethasone **(5).**Even though perineural administration of dexamethasone seems to be more effective than systemic use, and many providers use systemic dexamethasone to avoid mixing drugs that were not designed to be administered together, circumvent the problem of off-label perineural use, and profit from antiemetic effects of systemic dexamethasone **(6).** Doses between 4 to 10 mg have been used in adults **(7).**Steroids have a powerful anti-inflammatory action and have been demonstrated to reduce pain and swelling after different types of surgery, especially abdominal hysterectomy.However, the exact mechanism by which dexamethasone may

exert an analgesic effect is not fully understood. Systemic administration of steroids has been found to suppress tissue levels of bradykinin and the release of neuropeptides from nerve endings, both of which can enhance nociception in inflamed tissue **(8).**

The established reduction in prostaglandin production might further contribute to analgesia by inhibiting the synthesis of the cyclooxygenase isoform-2 in peripheral tissues and in the central nervous system. They also inhibit other mediators of inflammatory hyperalgesia, for example, tumour necrosis factor-a, interleukin-17b and interleukin-6. Thus, despite the fact that the mechanism is not yet fully understood, a reduction in pain by steroids has been supported by many studies **(9).**

The clinical effects of dexamethasone are related to changes in the transcription of DNA to proteins and continue for some time after the drug is cleared from plasma. The plasma elimination half-life is only about 6 h, and so there seems to be ongoing drug effects for a significant period of time after drug clearance from the plasma**(10).**

Thus, despite the fact that the mechanism is not yet fully understood, a reduction in pain by steroids has been supported by many studies. In addition, dexamethasone may have a direct action on the nerve membrane that causes a local anaesthetic effect, which augments the action of bupivacaine and prolongs its duration **(11).**

SUBJECTS AND METHODS:

This comparative prospective randomized double-blind controlled clinical trial was conducted atDepartment of Anaesthesia, Intensive Care and Pain Management, Zagazig University Hospitals on patients who were undergo elective abdominal hysterectomy at Zagazig UniversityHospitals, within six months.

Patient aged from 21-65 years with American Society of Anesthesiologists (ASA) [I, II], body mass index (BMI) (25 -30 kg/m^2) and elective hysterectomy were included in the study.

Contraindication to spinal anaesthesia as bleeding disorders, local infection, or severe valvular heart disease, contraindication to steroids, allergy to drugs used in the study, failed spinal, patients who had systemic disorders which could hamper the results of the study as diabetes mellitus, severe coronary insufficiency and/or Myocardial infarction, Severe renal or hepatic disorders and patients on steroid therapy were excluded from the study.

Preoperative:

All the patients were subjected to complete history taking, full clinical examination for all systems, routine laboratory investigations. The patients were allocated to three equal groups using computer-generated randomizing tables:

- ✓ Group (C) n=43: Control group who were received intrathecal Bupivacaine 0.5% 4cc plus 1cc normal saline.
- ✓ Group (D2) n= 43: who were received intrathecal Bupivacaine 0.5% 4cc plus 2 mg dexamethasone in 1cc volume.
- ✓ Group (D4) n= 43: who were received intrathecal Bupivacaine 0.5% 4cc plus 4mg dexamethasone in 1cc volume.

Intraoperative:

In the theatre two venous cannula was inserted and preloaded with 500 cc crystalloid. A standard monitor was applied including noninvasive blood pressure, pulse oximetry, and electrocardiography, and vital signs was recorded every 10 minutes intraoperative. Premedication with 1mcg/kg fentanyl plus 0.05 mg /kg midazolam and oxygen with nasal prong 2-4 L/min was connected. In sitting position and under complete aseptic technique and after preparing patients back with povidone-iodine 10% then alcohol 70%, intrathecal injection at L3-L4 intervertebral space by using 27 G pencil-point spinal needlein midline approach after local infiltration of the skin and subcutaneous tissues with 2-4ml lidocaine 1%, the introducer of the spinal needle grasped and the needle was introduced through it carefully till loss of resistance and sensing dural puncture. After ensuring adequate CSF backflow through the needle, 4 ml heavy bupivacaine 0.5% with 1 ml normal saline injcted in the C group, 4 ml of heavy bupivacaine 0.5% plus 2mg dexamethasone in 1ml volume in the D2 group, and 4 ml of heavy bupivacaine 0.5% plus 4mg dexamethasone in 1ml volume in the D4 group. The patient then turned to a supine position then a urinary catheter was introduced. Onset time was defined from the time of injection of drugs into the intrathecal space to the peak of sensory and motor block (highest dermatome level).

Sensory block assessment by placing a piece of cotton impregnated with alcohol on an area away from the possible dermatome covered with the spinal block (e.g. face or forearm) and ask them to tell us how cold it feels to them, then apply the piece of cotton impregnated with alcohol to an area likely to be blocked on the same side of the body and was ask the woman "Does this feel the same cold as your face/arm or different?" a woman may report colder, warmer or the same feeling, apply the piece of cotton impregnated with alcohol to areas above and below this point until it's clear at which level the top and the bottom of the block is. The procedure repeated on both sides of the body, the sensory block level was assisted every 2 minutes till the proper level is reached (T8-10 dermatome).

Motor assessment by Bromage scale measured to reach Bromage 3 before surgery, Bromage scale (0–3), 0: The patient can move the hip, knee, and

ankle, 1: the patient is unable to move the hip but can move knee and ankle, 2: the patient is unable to move the hip and knee but can move the ankle, 3: the patient cannot move the hip, knee, and ankle **(12).**

Heart rate and blood pressure was recorded every 10 minutes, hypotension more than 20% of basal blood pressure was treated by intravenous fluid bolus and ephedrine 5mg intravenous in incremental doses and any decrease in heart rate below 60/min was treated with intravenous atropine (0.01 mg/kg).

Post-operative:

At the end of the surgery, the patients were transferred to the post Anaesthesia care unit (PACU). They were receiving 1 gm paracetamol and 75 mg diclofenac by intravenous infusion as a part of standard multimodal analgesia. Motor and sensory blocks was assessed every 30 minutes in the post-operative period. Duration of sensory block is the period between the peak of sensory block till the patients feel pain at the site of surgery, VAS >0, while the duration of motor blocks that period between the beginning of the motor block to a point of recovery of motor function of lower limbs muscles, Bromage =0. Sedation was monitored using the modified Observer's Assessment of Alertness/Sedation Scale (OAA/S). It is a six-point scale ranging from 5 to 0 (where a score of 5 is an alert patient, score 4 = lethargic responses to name in a normal tone, corresponding to mild sedation levels, a score of 3 = responds only after the name is called loudly repeatedly, corresponding to moderate sedation levels, score 2 = responds only after mild prodding or shaking, score 1 = does not responds to mild prodding or shaking, score 0 = does not respond to a deep stimulus((trapezius squeeze) **(13)**.

Pain was measured with a visual analog scale (VAS). A scale ranges from 0 to 10; where 0: no pain and 10: the worst imaginable pain) at rest and during mobilization, the (VAS) was measured using a 10 cm ruler according to the self-reporting by patients. In this method, the patient was asked to indicate zero in case of having no pain and 10 if she has the most severe pain. For pain, a score < 4 was considered as mild, 4-6 as moderate, and 7-10 as severe. If VAS > 3, nalbuphine 10gm intramuscular was given as rescue analgesia **(14).**

C-Administrative design:

Ethical Approval:

Informed consent was obtained from all those who was included in the study. Approval of Institutional Review Board (IRB) of faculty of medicine Zagazig University.

STATISTICAL ANALYSIS:

Data were fed to the computer using IBM SPSS software package version 24.0. Chi-square test, independent t-test and F-test (ANOVA) were used.

RESULTS

This study was a comparative prospective randomized double-blind controlled clinical trial study carried on Patients who were undergo elective abdominal hysterectomy within six months in Department of Anaesthesia, Intensive Care and Pain Management, Zagazig University Hospitals.

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

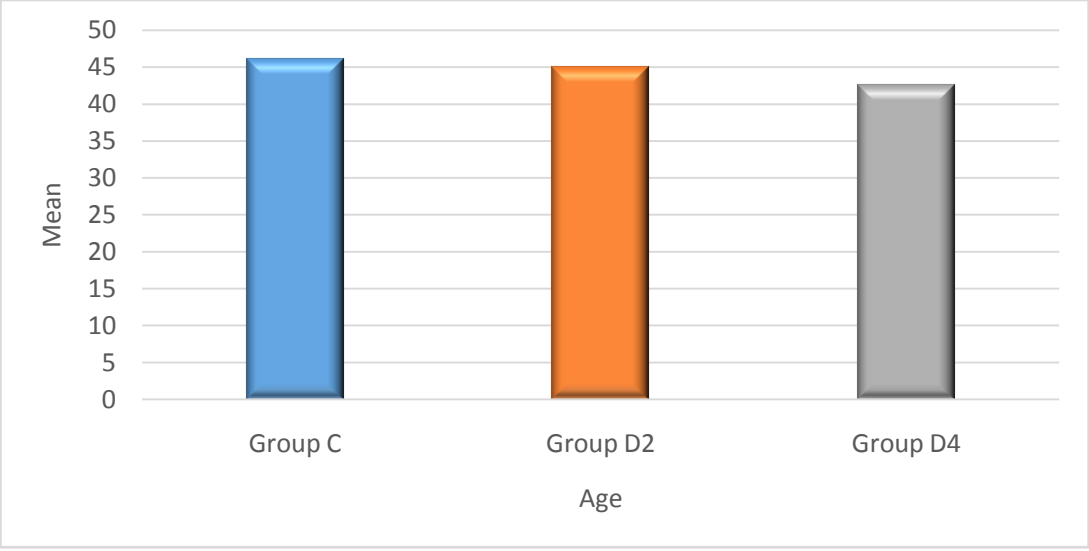

Figure (1): Comparison between the three studied groups regarding age (years).

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

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

Heart rate	10 min I.O.	20 min	30 min	40 min	50 min	60 min	70 min	80 min	90 min	100 min	110 min.	30 min P.O	60 min. P.O.	6 hrP.O	12 hr. P.O	18 hr. P.O.	24 hr. P.O.
Group C	60-98	61-93	61-98	65-98	63-92	62-96	65-98	65-97	61-99	65-95	65-94	68-98	62-99	63-103	66-97	60-102	61-98
Range	76.58	76.51	81.16	80.49	79.47	80.63	81.88	81.63	81.74	80.28	78.14	81.02	79.58	81.65	81.30	77.21	78.98
Mean	10.63	9.21	10.39	9.38	9.00	10.35	10.83	9.20	9.93	8.27	8.91	9.08	10.22	10.47	9.60	11.01	11.31
SD																	
Group D2	57-106	65-104	64103	64-99	65-99	64-97	64-99	64-101	64-110	64-98	65-99	65-96	61-95	64-99	66-101	64-100	57-103
Range	76.88	78.42	77.21	78.21	79.40	79.26	79.81	79.51	80.09	77.12	78.16	77.84	79.26	79.30	81.44	78.21	78.51
Mean	11.47	10.84	10.73	10.77	11.74	10.67	10.50	11.01	12.33	10.59	10.58	10.18	10.88	11.07	10.81	10.58	11.82
SD																	
Group D4	63-96	65-94	65-97	59-98	64-95	63-93	65-95	62-98	59-97	60-95	63-93	59-94	62-93	61-93	61-92	63-95	65-97
Range	76.51	76.60	76.44	75.79	75.72	76.02	76.33	77.02	76.05	76.42	77.21	76.84	78.00	75.72	76.33	80.33	81.05
Mean	9.07	7.50	7.14	8.88	8.89	8.55	8.06	8.55	9.86	9.49	8.60	9.35	9.55	8.89	9.47	10.79	10.83
SD																	
P1	0.450	0.191	0.043	0.149	0.488	0.273	0.185	0.168	0.248	0.063	0.496	0.065	0.443	0.158	0.475	0.334	0.426
P2	0.487	0.480	0.008	0.010	0.028	0.014	0.004	0.009	0.005	0.024	0.312	0.019	0.230	0.003	0.009	0.094	0.194
P3	0.434	0.185	0.349	0.130	0.053	0.062	0.044	0.123	0.048	0.374	0.324	0.318	0.285	0.051	0.011	0.180	0.151

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 (2) showed that there was no statistically significant difference between group C with 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 period from 10 min. I.O to 100 min I.O (P3<0.05) regarding mean blood pressure.

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

Mean blood pressure	10 min I.O.	20 min	30 min	40 min	50 min	60 min	70 min	80 min	90 min	100 min	110 min.	30 min P.O	60 min. P.O.	6 hrP.O	12 hr. P.O	18 hr. P.O.	24 hr. P.O.
Group C	62-109	75-108	76-108	74-110	75-105	73-107	72-106	72-107	70-103	73-105	72-108	71-107	70-106	69-107	70-103	72-102	71-101
Range	84.74	89.84	89.51	88.70	87.88	88.79	88.67	88.95	88.47	89.79	89.60	90.19	88.91	90.23	90.47	90.67	90.02
Mean	11.78	8.97	8.89	9.45	8.45	8.50	8.26	8.14	7.73	7.35	8.45	8.67	8.38	8.97	7.58	7.83	7.89
SD																	
Group D2	72-108	69-106	68-104	70-105	71-103	70-105	67-106	72-102	71-105	69-109	75-107	72-107	71-108	69-107	68-105	72-103	73-109
Range	89.19	87.09	88.63	88.37	88.09	87.49	86.95	87.65	87.56	87.86	87.93	87.65	88.05	87.81	87.77	87.98	88.14
Mean	9.55	10.46	9.82	9.74	9.19	9.79	10.34	9.28	10.15	10.65	9.27	9.62	9.31	9.40	9.19	8.21	9.10
SD																	
Group D4	65-95	65-98	66-97	66-99	65-98	64-96	65-97	65-96	68-96	69-97	67-98	68-99	69-100	70-103	71-102	70-104	71-97
Range	80.26	79.47	79.70	80.16	80.35	79.79	80.72	81.12	82.40	83.72	85.51	84.40	85.37	85.21	85.56	86.00	85.95
Mean	8.26	9.74	9.36	9.14	9.15	9.04	8.62	8.38	8.68	8.75	8.04	9.25	8.99	9.26	9.15	9.05	7.53
SD																	
P1	0.029	0.098	0.331	0.438	0.456	0.256	0.198	0.245	0.321	0.165	0.192	0.101	0.327	0.113	0.071	0.061	0.154
P2	0.022	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.012	0.002	0.031	0.006	0.004	0.006	0.008
P3	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.007	0.026	0.100	0.057	0.090	0.100	0.133	0.146	0.114

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 (3) showed that sensory block duration time in group C ranged from 98-306 min. with mean value 204.28±53.90, in group D2 ranged from 100-454 min. with mean value 270.56±69.63 and in group D4 ranged from 112-468 min. with mean value 273.40±107.48. There was no statistically significant difference between group C with group D2 (P1>0.05) while there was statistically significant difference between group C with D4 and between group D2 with D4 regarding sensory block duration time (P2, P3 < 0.05).

Table (3): Comparison between the three studied groups regarding sensory block duration time (min)

Sensory block duration time (min)	Group C	Group D2	Group D4
Range	98-306	100-454	112-468
Mean	204.28	270.56	273.40
SD	53.90	69.63	107.48
p1	0.442		
p2	0.0001		
p3	0.000		

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

Table (4): Comparison between the three studied groups regarding Motor block duration time

Motor block duration time	Group C	Group D2	Group D4
Range	96-346	95-253	94-322
Mean	197.49	158.02	216.67
SD	59.96	44.14	43.91
p1	0.047		
p2	0.000		
p3	0.000		

Figure (2) showed that there was no statistically significant difference between group C with group D2 at different periods of follow up (P1> 0.05) while there was statistically significant difference between group C with D4 at different periods of follow up (P2< 0.05), there was statistically significant difference between group D2 with D4 from period 0 hr. to 12 hr P.O (P2 < 0.05) regarding post-operative pain.

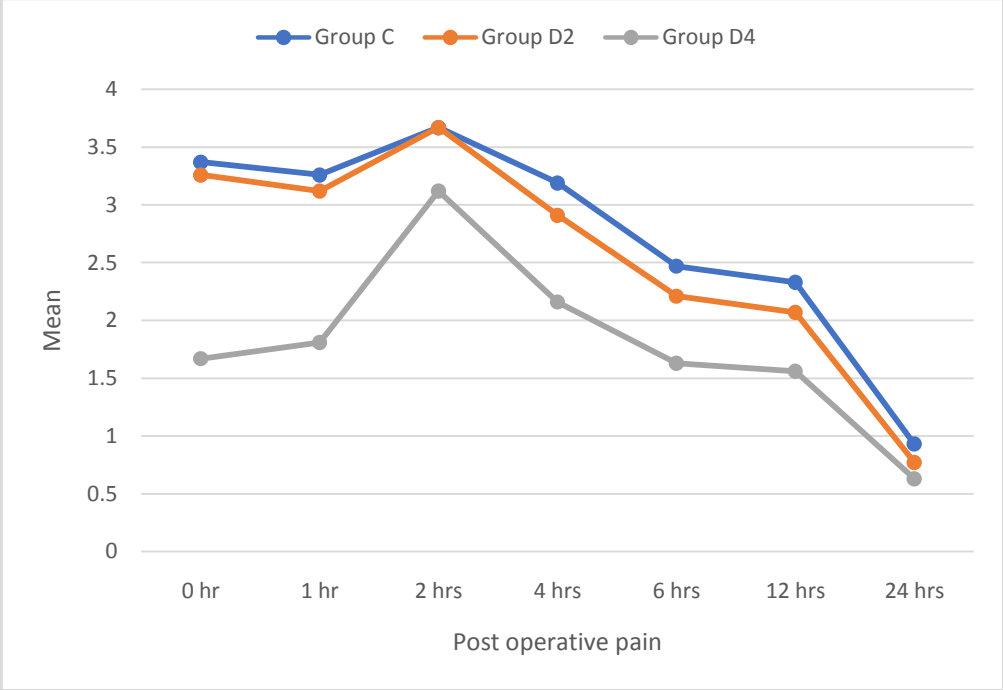

Figure (2): Comparison between the three studied groups regarding Post-operative pain

Figure (3) showed that in group C, total opioid consumption in the first 24 hour ranged from 10-25 gm with mean value 15±4.76, in group D2 ranged from 10-25 gm with mean value 14.19±4.49 and in group D4 ranged from 5-15 gm with mean value 10.35±3.16. There was statistically significant difference between group C with D4 and group D2 with D4 (P2, P3< 0.05) while there was no statistically significant difference between group C with D2 (P1> 0.05) regarding total opioid consumption in the first 24hour.

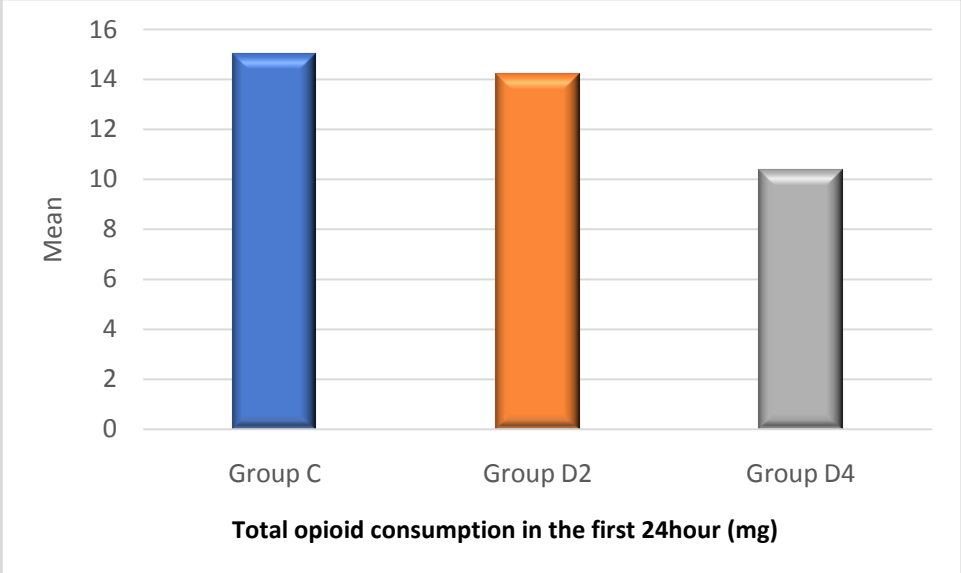

Figure (3): Comparison between the three studied groups regarding Total opioid consumption in the first 24hour (mg).

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

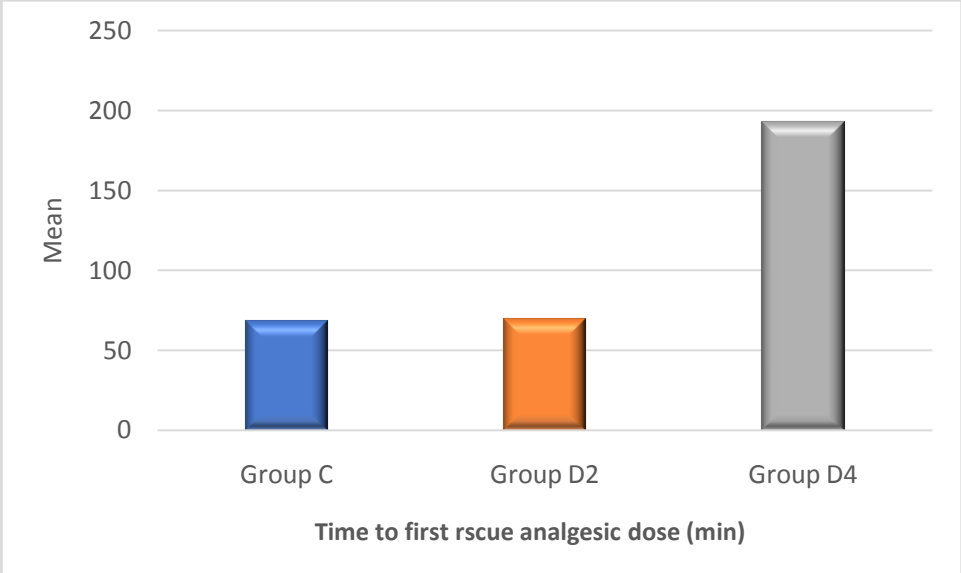

Figure (4): Comparison between the three studied groups regarding Time to first rescue analgesic dose (min).

Figure (5) showed that there was statistical 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).

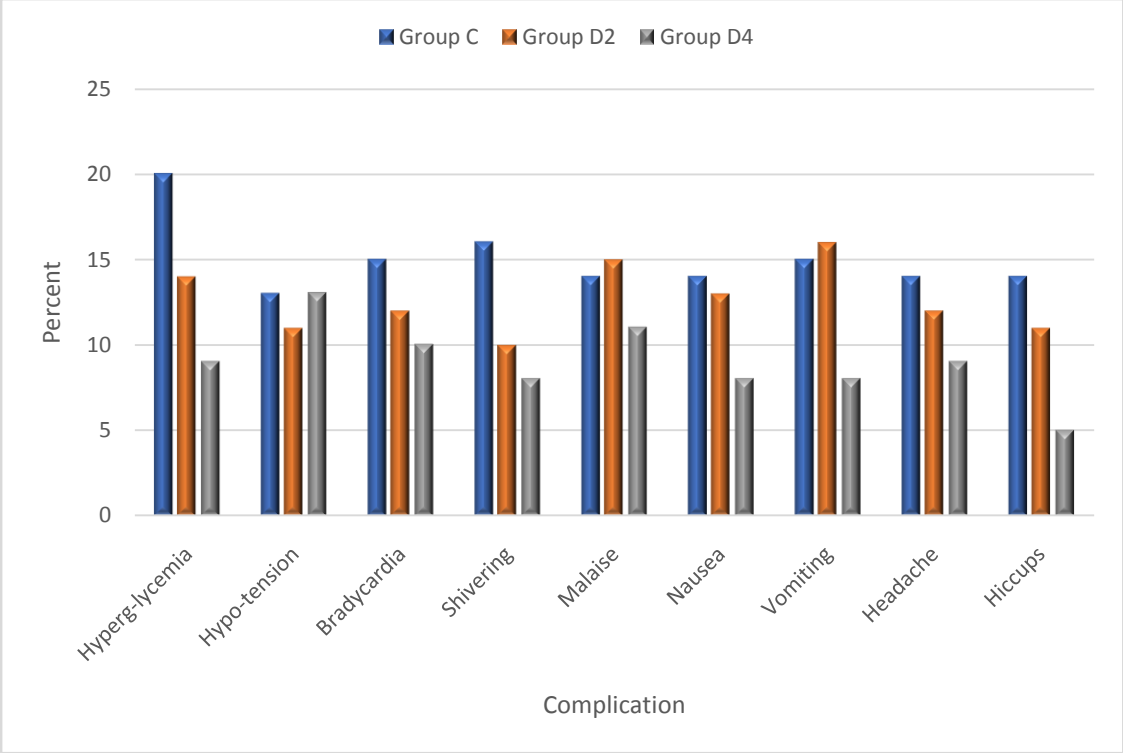

Figure (5): Comparison between the three studied groups regarding Complication.

Table (5) showed that in group C, excellent satisfaction were none while the higher ratio were poor satisfaction with 15(34.88%), in group D2 also excellent satisfaction were none while the higher ratio were fair with 15(34.88%), in group D4, poor satisfaction were none while the higher ratio were very good 13(30.23%). There was statistical significant between the three studied groups regarding patients satisfaction (P<0.05).

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

Patients satisfaction	Group C		Group D2		Group D4	
	No	%	No	%	No	%
Poor.	15	34.88	0	0.00	0	0.00
Fair	7	16.28	15	34.88	12	27.91
Good	9	20.93	14	32.56	7	16.28
Very good	12	27.91	14	32.56	13	30.23
Excellent	0	0.00	0	0.00	11	25.58
X^2	38.52					
P value	0.001*					

Figure (6) showed that there was statistical 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 statistical significant difference at 0 hr P.O. (P> 0.05).

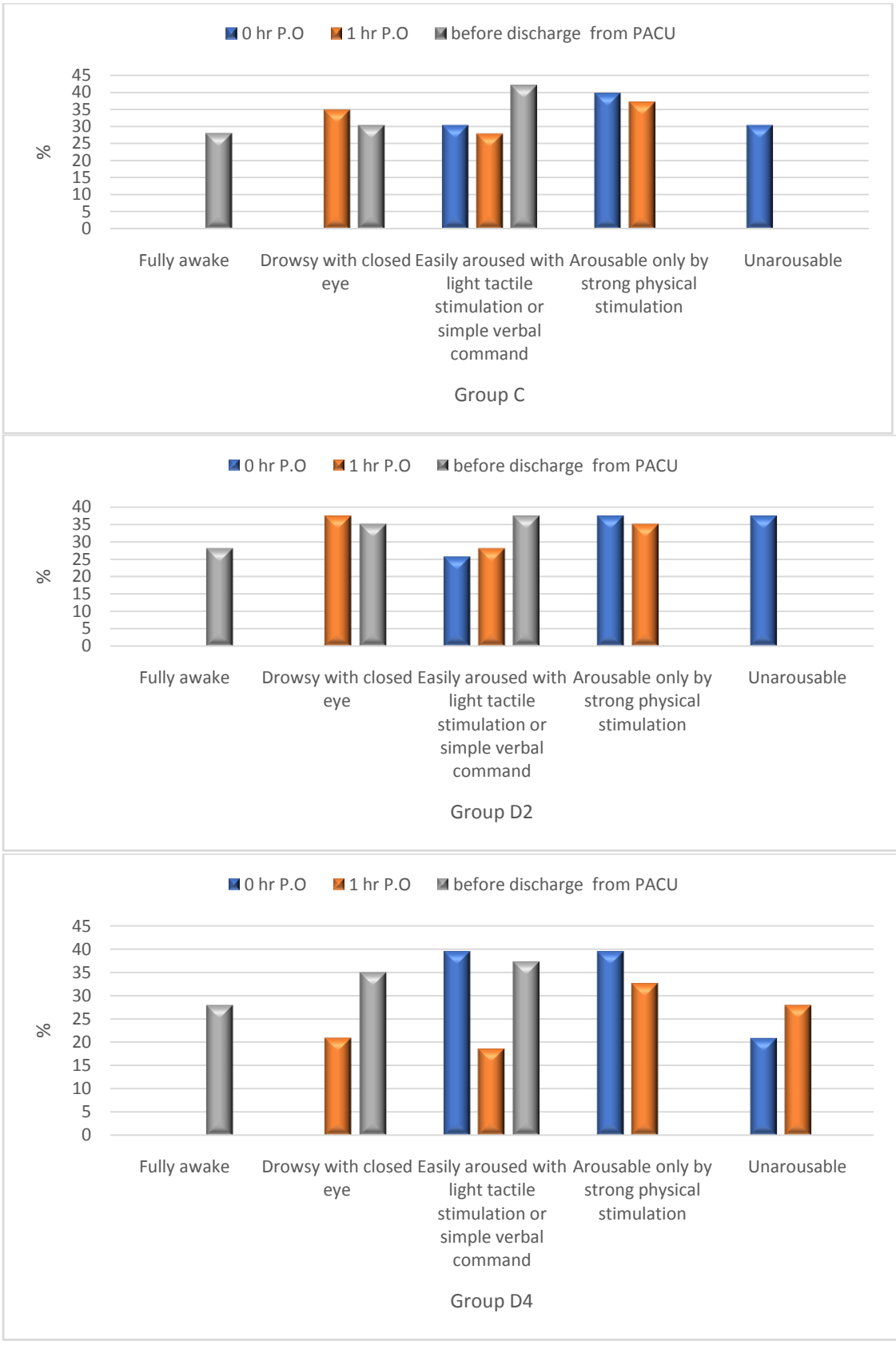

Figure (6): Comparison between the three studied groups regarding sedation score.

Discussion:

Our results, showed that the demographic and basic clinical data including, age and ASA of the three studied groups was matched without significant difference, this results was important to eliminate the effect of demographic data on the final results.

Regarding heart rate and mean arterial blood pressure, it was found the heart rate and mean arterial blood pressure was lower in group D4 less than other two groups, the decreasing in heart rate and mean arterial blood pressure in group D4 due to the significant decrease in pain score in this group comparing with other two groups.

The result of our study showed that the sensory and motor block was significantly higher in group D4 more than the control group.

Shalu and Ghodki 2 assigned sixty patients into two groups in a randomized and double-blind method to receive injection dexamethasone 4 mg intravenously (intervention group) and group control received injection normal saline 2 cc immediately after spinal anaesthesia and injection bupivacaine 0.5% heavy 10 mg through spinal anaesthesia was received by all patients. They showed that dexamethasone administration of 8 mg intravenously was successful to prolong the post-operative analgesia and sensory block among patients underwent cesarean section under spinal anaesthesia**(15).**

A few researches have been conducted on the effects of combination of dexamethasone with bupivacaine on prolongation of the duration of action of local aesthetic in patients undergoing cesarean section under spinal anaesthesia .**Shalu and Ghodki (15)** reported that administration of 8 mg of dexamethasone intravenously prolong the duration of post-operative analgesia and sensory nerve block. **Sachdeva et al (16)** also reported that adding 8mg dexamethasone to bupivacaine in transversus abdominal plane (TAP) block prolonged the duration of the block without any complication **(16).**

The results of our study showed that the post-operative pain was significantly lower in group D4 more than control group and D2. On the other hand the Total opioid consumption in the first 24hour (mg) was significantly lower in group D4 less than control and D2 group. also, the time to first rescue analgesic dose (min) was significantly higher in group D4 more than the other two groups.

Taguchi et al. reported that intrathecal injection of betamethasone successfully decreased the pain score in three patients with intractable cancer pain **(17).**

Another study reported that dexamethasone (4 mg) reduces post-operative pain score and morphine consumption following laparoscopic cholecystectomy with no apparent side effects **(18).**

Some authors also believe that analgesic properties of dexamethasone are the results of their systemic effects. The block prolonging effect may be due to its local action on nerve fibers. Previous works demonstrated that addition of dexamethasone to local anaesthetics prolonged duration of blockade of peripheral nerves. A study in supra-clavicular block suggests that the addition of dexamethasone to bupivacaine significantly prolonged duration of analgesia. **(19)**

Another study in axillary block reported that dexamethasone when added to lidocaine significantly prolongs duration of analgesia without any change in onset **(20).**

Multiple studies suggest that intermediate doses of corticosteroids, such as dexamethasone, seem to be the safest and most effective option of multimodal analgesia. It also shows that analgesia is greater when steroids are administered preoperatively (at least 1 h before surgery) or during the induction of anaesthesia. Hence, post-operative pain treatment with a multimodal technique that includes dexamethasone, decreases pain scores and the use of rescue analgesia during the first 24 h of the immediate post-operative period. The results of our study were no exception. **(18)**

The incidence of complication was significate lower in group D4, so the patients satisfaction was significantly higher in group D4 more than the other two groups. Finally, the sedation score shows insignificant.

Chen et al.'s (21) meta-analysis found that dexamethasone in TAP block associated with a 72% decrease in the incidence of (POVN) compared with local anaesthetics alone, due to reduction in opioid consumption **(22)**; we did not use opioid in the rescue analgesia, and this may explain the low incidence of post-operative nausea and vomiting in our results.**(21, 22)**.

CONCLUSION:

Post-operative pain scores were lower in the dexamethasone group with dose 4 mg, while the incidence of adverse effects was similar to group with dose 2mg and less than control group. Intrathecal dexamethasone 4 mg in combination with a Bupivacaine augmented the intensity and duration of post-operative analgesia without adverse effects in women undergoing abdominal hysterectomy surgery.

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