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Addition of Dexamethasone to Bupivacaine in Spinal Anesthesia for Elective Caesarean Section

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Abstract—Background*: Subarachnoid block is the most commonly administered neuraxial anesthetic for cesarean delivery because of its simplicity, speed of onset, and reliability. Dexamethasone has anti-inflammatory and analgesic action by inhibition of transmission in nociceptive C -fiber and neural discharge.* ***Aim****: to compare the effect of adding dexamethasone to bupivacaine in comparison to bupivacaine alone in spinal anesthesia (onset, duration, hemodynamics stability, nausea and vomiting).* ***Patient and methods****: 100 pregnant women underwent cesarean section under spinal anesthesia were randomly divided into two groups, the patients received 10 mg(2 ml) of 0.5 % hyperbaric bupivacaine combined with 2 mg (o.5 ml) dexamethasone in group dexa p as a study group and 10 mg (2 ml) of 0.5% hyperbaric bupivacaine combined with 0.5 ml normal saline in p group as a control group . hemodynamic parameters and sensory perception during surgery were evaluated.* ***Results****: the comparison between two study groups by hemodynamic parameters of mean arterial blood pressure, pulse rate, sensory loss duration. There were more stable mean arterial blood pressure and lower pulse rate in dexamethasone group. Regarding the sensory duration were longer in dexa p group (3.94 -+0.82 hours) in comparison to only p group (2_+0), with 1.94 hours.* ***Conclusion****: intrathecal bupivacaine combined with 2 mg dexamethasone s associated with longer duration of sensory loss than a combination of bupivacaine and normal saline.*

Keywords— *Dexamethasone; spinal anesthesia; cesarean section*.

I. INTRODUCTION

Bupivacaine: Bupivacaine is a well-known local anesthetic drug belonging to the amide group. Its pKa is 8.1, which means that only 15% of the drug will be found as uncharged form at normal tissue pH (1). It is now well understood that the charged portion of bupivacaine can travel freely across the neuronal membrane, exerting the anesthetic action at the target molecular site, the voltage-dependent sodium channels (2). Primarily, bupivacaine changes the resting state membrane potential of nerve axons rendering them less excitable by binding the inner surface of sodium channels. This will inactivate the channels, preventing sodium from entering the axons, and hence, diminishes the capability of starting an action potential (3). This being said, bupivacaine is a membrane-stabilizing drug. Longer duration of action is another characteristic of bupivacaine, which makes it a favorable choice for regional anesthesia. The latter can be explained by its slow release from sodium channel binding sites (2). The main site of bupivacaine metabolism is in the liver by glucuronide conjugation and N-dealkylation.
It is then being excreted in urine in the form of hydroxylated pipecolylxylidine, while small amount is still excreted unchanged (4). In anesthesiology practice, bupivacaine is used in regional anesthesia techniques including infiltration, nerve block, epidural and intrathecal anesthesia. The contraindication being the intravenous regional anesthesia, for which a risk of systemic absorption and fatal cardiotoxicity can result in patient's death (3).
Dexamethasone

It is known that dexamethasone has anti-inflammatory and analgesic action by inhibition of transmission in nociceptive C -fiber and neural discharge. When given as an additive in peripheral nerve blocks or in intrathecal anesthesia, it prolongs the duration of anesthesia.

Dexamethasone is known to reduce the gradient between central and peripheral tissue temperatures that is why it has been used as an intravenous medication to decrease shivering. It has been also used to be injected in the cerebrospinal fluid safely and can be given as an adjuvant to local anesthetics to enhance the efficacy of regional anesthesia (5).
Aim of study: The aim of this study was to compare the effect of adding dexamethasone. to bupivacaine in comparison to bupivacaine alone in spinal anesthesia (onset, duration, hemodynamics stability, nausea and vomiting)

II. PATIENTS AND METHODS

Patients: A prospective, randomized study was carried out in Gynecology & Obstetric operation theaters of Baghdad Teaching Hospital, and Al-Yarmouk teaching hospital, Baghdad, Iraq, during the period from 1st of April, 2021 to 1st of September, 2021. Legal approval of the study was obtained from the Iraqi Board Council, written informed consent from each participant in the study and permission from the hospital were obtained.

100 full-terms pregnant women were included in this study; divided blindly into two groups: group A, and B (number of each group 50).
The inclusion criteria:
 Scheduled for elective cesarean section under spinal anesthesia.
 Full-terms pregnant women, 17-40 years of age.
 ASA class -II.
 BMI 18.5_35 kg/m2.
2.3 The exclusion criteria:
 Patient refusal
 Any contraindication to spinal anesthesia.

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 Contraindications to the drugs used in the study.

Data collection: Data were collected using pre-constructed form sheet including name, age, height, weight & body mass index (BMI). A detailed history was obtained, a general examination was done and investigations were evaluated. On arrival to the operating room, all patients with 8-hour fasting were monitored for basal vital signs (ECG, HR, NIBP, Spo2, Temp).

Anesthetic protocol: A wide –bore intravenous cannula (G: 18) in to a forearm vein was inserted. Patients received Ringer`s Lactate 1 liter was started as a pre -load. at room temperature.

The operating room temperature was maintained at 22_24 C . Heart rate, mean arterial blood pressure were monitored every 3 min for the first 15 min. And then every 5min for 30 min. And then every 30 min to the end of operation.

Under a septic condition, in a sitting position, spinal anesthesia was performed at the L3_L4 spinal interspaces with 25G Quinke spinal needle. The patients received 10mg (2 ml) of 0.5% hyperbaric bupivacaine combined with 2 Mg (0.5ml) dexamethasone in Dexa p group as a study group and 10 mg (2 ml) of 0.5% hyperbaric bupivacaine combined with 0.5ml Normal saline in only p group as a control group, respectively. On completion of spinal injection the patient was placed in the supine position with 30 degree left uterine displacement by placing a wedge under the right hip. Onset of anesthesia was confirmed by asking the patient about numbness of the legs and the operation began after the sensory block at dermatome T5 determined by the loss of cold stimulus sensation. Oxygen was administered at the rate of 5 lit/min by a face mask.

Episodes of perioperative side effects such as hypotension (SBP <20% from baseline or < 100 mmHg) bradycardia (HR< 50 bpm) Hypotension was treated with bolus of fluid and incremented dose of ephedrine 5 mg IV and bradycardia was treated with atropine 0.5 mg IV. Intravenous metoclopramide 10 mg was used to treat nausea and vomiting. All the mentioned drugs for management of the side effects used as a rescue drugs.

III. Results

There were 50 patients enrolled in this study in each group, the mean age group in Dexa P group was 24.94 years ±5.89 years of standard deviation (SD), which showed no statistically significant difference from mean age of Only P group of 25.64±6.17 years. There was no statistically significant difference in mean BMI between the two study groups, as shown in Table 1.

TABLE 1: Demographic data of the study group

Variables	DexaP Group	OnlyP Group	P-value
Age	Mean± SD	Mean± SD	
	24.94±5.89	25.64±6.17	0.563
BMI	Mean± SD	Mean± SD	
	30.74±1.75	30.42±1.63	0.346

No significant difference in mean ages between the two groups. However, there was a statistically significant delayed onset of anesthesia (3.51±0.62 min) in DexaP group compared to OnlyP (1.35±0.43 min), with mean difference of 2.164 min. There was no significant difference in motor block duration between the two study groups, while sensory block lasted longer in DexaP group (3.94±0.82 hours) in comparison to OnlyP group (2±0), with 1.94 hours longer duration. Regarding maintenance of hemodynamic status, DexaP group showed lower need for ephedrine and lower need for fluid replacement in comparison to OnlyP group, 4.34±1.48 mg in comparison to 13.96±6.39 mg, and 1.17±0.34 litters and 1.46±0.47 litters, respectively. As shown in Table-3.2.

TABLE 2: Comparison of onset and duration of anesthesia, and maintenance of hemodynamic status between the two study groups

Variables	DexaP Group	OnlyP Group	Difference	P-value
	Mean± SD	Mean± SD	Mean	
Onset in minutes	3.51±0.62	1.35±0.43	2.1640	<0.001
Sensory duration in hours	3.94±0.82	2±0	1.9400	<0.001
Motor duration in hours	2.73±0.8	2.66±0.48	0.0700	0.596
Ephedrine dose in mg	4.34±1.48	13.96±6.39	-9.6200	<0.001
Fluid in litters	1.17±0.34	1.46±0.47	-0.2900	0.002

The MAP was significantly higher in DexaP group at 4, 7, 10, 15, 25, and 120 minutes, and it can be seen in Table-3 and Figure-1 that MAP in DexaP group was more stable and showed less steep drop at 7 minutes, as in it was 74.46±5.19 mmHg while in OnlyP group it reclined to 66.26±4.4 mmHg, with a mean difference of 8.2 mmHg.

TABLE 3: Comparison of mean arterial blood pressure according to group and time

Variables	DexaP Group	OnlyP Group	Difference	P-value
Baseline	81.24±4.68	81.48±3.02	-0.24	0.761
1 min	77.68±5.66	76.6±3.51	1.08	0.255
4 min	73.14±4.98	70.38±3.65	2.76	0.002
7 min	74.46±5.19	66.26±4.4	8.20	<0.001
10 min	76.36±4.3	69.06±4.7	7.30	<0.001
15 min	78.14±4.4	74.18±3.4	3.96	<0.001
20 min	79.42±5.3	78.38±4.7	1.04	0.298
25 min	81.16±2.8	79.36±2.9	1.80	0.002
30 min	80.78±3.35	79.84±3.36	0.94	0.164
60 min	79.84±3.75	79.92±3.99	-0.08	0.918
90 min	79.88±1.71	79.9±3.3	-0.02	0.970
120 min	79.28±2.51	80.54±2.7	-1.26	0.017
Independent sample t test				

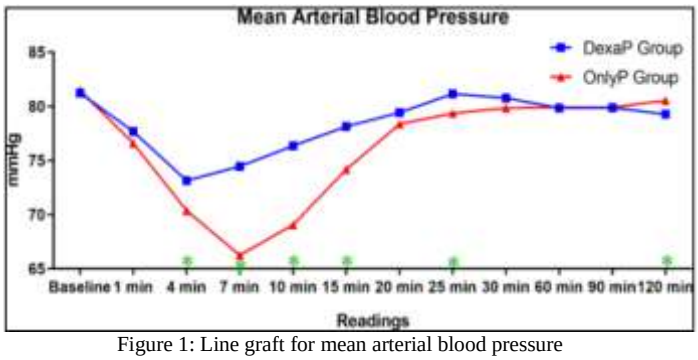

Figure 1: Line graft for mean arterial blood pressure

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The pulse rate was significantly lower in DexaP group in comparison to OnlyP group at 4, 7, 10, and 15 minutes, the highest difference was seen at 7 minutes, as the PR was 75.12±7 BPM in DexaP group in comparison to 95.3±7.2 BPM in OnlyP group, with 20.98 BPM mean difference, as shown in Tabl-4. Figure-2 shows that although the pulse rate was lower in DexaP group, it was more stable in OnlyP group.

TABLE 4: Comparison of mean pulse group according to group and time
Variables DexaP Group OnlyP Group Difference P-value

Variables	DexaP Group	OnlyP Group	Difference	P-value
Baseline	105.24±9.62	103.54±7.77	1.70	0.333
1 min	105.38±7.53	102.42±7.32	2.96	0.049
4 min	87.52±6.37	97.06±5.16	-9.54	<0.001
7 min	74.32±6.47	95.3±7.2	-20.98	<0.001
10 min	75.12±7	94.26±5.6	-19.14	<0.001
15 min	85.84±6.2	91.52±8.1	-5.68	<0.001
20 min	90.88±5.6	93.5±8.2	-2.62	0.066
25 min	94.4±8.1	92.86±8.4	1.54	0.352
30 min	93.24±5.23	95.1±8.27	-1.86	0.183
60 min	92.02±7.78	91.04±5.92	0.98	0.480
90 min	93.06±6.52	93.66±8.88	-0.60	0.701
120 min	92.66±7.72	93.94±9.3	-1.28	0.456
Independent sample t test				

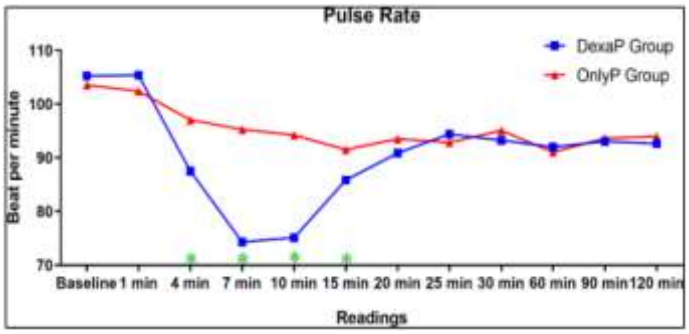

Figure 2: Line graft for pulse rate

IV. Discussion

In our research we added 2 mg of dexamethasone to hyperbaric bupivacaine for spinal anesthesia in patient undergoing cesarean section, shows prolongation of the sensory duration. A study published by Mahamoud Ali El-Shourbagy and his colleagues (6), they use 8 mg dexamethasone to hyperbaric bupivacaine shows similar results regarding the duration of sensory block without affecting on the onset, which was delayed in our research.

Another study showed agreement with our results regarding improvement of post-operative pain relief and sensory block duration, a study published by Nadia Bani-Hashem and her colleagues (7) they added 8 mg of dexamethasone to hyperbaric bupivacaine in spinal anesthesia for orthopedic surgeries.

A study published ANAS AMER MOHAMMAD and his colleagues (8), in their study they used different doses of dexamethasone, according to their results showed two parts, first on is adding 2 mg of dexamethasone to hyperbaric bupivacaine shows similar clinical in compares to higher doses than 4 mg, secondly showed that increase in sensory block and post-operative analgesia similar to our results.

Another study published by Atsuhrio reported that intrathecal or epidural use of mythel predsilone decreases the continuous pain in patients with post herpetic neuralgia, the intrathecal use of steroids was reported better analgesic effect than epidural use , the interleukin 8 used as a marker in his study was significantly reduce in CSF in those who had intrathecal steroids. (9) Taguchi et al. reported that use of betamethasone intrathecally cause reduction in pain score in patients with intractable cancer pain (10), in his study shows significant reduction in opioid use similar results obtained from our research, reduction in post-operative analgesia use and early mobility was obtained from our study.

Regarding the hemodynamic status in patients with dexa group in our research shows that more reduce in hypotension attacks and reduce in total doses of ephedrine, no similar study shows these results apart.

V. Conclusion

In conclusion, our study demonstrated that intrathecal bupivacaine combined with dexamethasone 2 mg is associated with longer sensory block duration and hemodynamics stability than a combination of bupivacaine and normal saline.

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