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Original Article

EFFECTS OF DEXAMETHASONE AS AN ADJUVANT TO ROPIVACAINE ON DURATION AND QUALITY OF POST-OPERATIVE ANALGESIA IN ULTRASOUND-GUIDED TRANSVERSUS ABDOMINIS PLANE BLOCK IN PATIENTS UNDERGOING LOWER-SEGMENT CESAREAN SECTION

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ABSTRACT

Objective: The aim of this study was to measure the effect of adding dexamethasone to ropivacaine on the duration and quality of post-operative analgesia in patients undergoing lower-segment caesarean section (LSCS) who are receiving ultrasound-guided transverse abdominal plane (TAP) blocks.

Methods: An interventional, prospective, randomized, and double-blind trial was conducted at a hospital. Before beginning the investigation, the Institutional Ethics Committee permission was acquired. The patient characteristics were analyzed using the Students t-test for continuous variables and the Chi-square test for categorical variables. A total of 60 patients were randomly split into two groups of 30 each.

Results: Time to first rescue analgesia was significantly shorter in Group R (11.62±3.80 h) than the Group D (19.04±4.20 h) ($p<0.001$). The total tramadol requirement in post-operative period was significantly higher in Group R (86.67±30.55 mg) than the Group D (35.56±39.54 mg) ($p<0.001$).

Conclusion: The use of dexamethasone along with 0.1% ropivacaine prolongs the analgesic duration of TAP block in patients undergoing LSCS.

Keywords: Dexamethasone, Lower-segment caesarean section, Ropivacaine.

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INTRODUCTION

Significant post-operative pain from a lower segment cesarean section (LSCS) can make it difficult to walk, breastfeed or even bond with the baby. After LSCS, there is nociceptor-mediated somatic pain at the surgical site and visceral pain due to uterine incision. After surgery, post-operative analgesia is crucial to avoid several problems such as venous thromboembolism, respiratory distress, and prolonged hospitalization [1,2]. Considerable pain and suffering can be expected after cesarean section; therefore, the analgesic regimen should provide adequate and safe analgesia.

After LSCS, several methods of pain relief are used. The transverse abdominal plane (TAP) block has recently become more popular due to its widespread use, simplicity, and improved margin of safety since the development of ultrasound [3,4]. The TAP lies on the surface of the transverse abdominis muscle in the anterolateral abdominal wall. Thoracic nerves (T6-L1) are located in the TAP and can be blocked with local anesthesia to provide post-operative analgesia [5].

Compared to lignocaine, ropivacaine has a longer duration of action and better safety than bupivacaine. Today, the use of ropivacaine is standard procedure for the treatment of fascial plane and nerve blocks. When used as an adjunct to peripheral nerve blocks, dexamethasone is a highly effective long-acting glucocorticoid with analgesic, antiemetic, and anti-inflammatory effects. It also has the added benefit of reducing post-operative nausea and vomiting.

Aim

The aim of the study was to evaluate how long and how well patients undergoing ultrasound-guided TAP block during LSCS responded to the addition of dexamethasone to ropivacaine. To evaluate the effectiveness of post-operative analgesia, rescue analgesia required within 2 h, time required to administer the initial dose, and VAS assessments are used.

METHODS

An interventional, prospective, randomized, and double-blind study was conducted in the hospital. The approval of the Institutional Ethics Committee was obtained before the start of the study. Written informed consent was obtained before commencement of the study. The study included patients aged 18 years or older with ASA grade I or II undergoing elective or urgent LSCS. Patients with a history of allergy to any of the study drugs, bleeding problems, or infections at the closure site were excluded from the study.

A total of 60 patients were randomly assigned to two groups of 30 using a chit-box approach. The method of anesthesia was described for each patient.

Group R (n=30) received 0.1% ropivacaine in 20 mL plus 2 mL of normal saline. Total volume: 22 mL

Group D (n=30) received 0.1% ropivacaine in 20 mL plus 8 mg dexamethasone (2 mL) total volume: 22 mL both patient and observer were unaware of the study drug. Prefilled syringes with study medication were available.

TAP blockade was administered bilaterally after surgical wound closure according to strict aseptic guidelines. The anterior axillary line between the iliac crest and the costal border was the location of the needle entry point. After parting and probe preparation, a 38 mm linear probe (SonoSite M-Turbo, Fujifilm USA) was placed perpendicular to the skin.

Under ultrasound guidance, a SonoPlex Stim 22G, 80 mm tip was placed between the internal oblique and transverse abdomen using a plane technique. Before LA injection, one cc of sterile water was administered to ensure that the tip of the tip was in the correct position. On ultrasound, LA distribution was seen as hypoechoic widening between fascial planes (Fig. 1). All patients had bilateral TAP block (both sides, 11 mL). At the end of the block, all patients in both groups received 1 g paracetamol intravenously as part of multimodal analgesia.

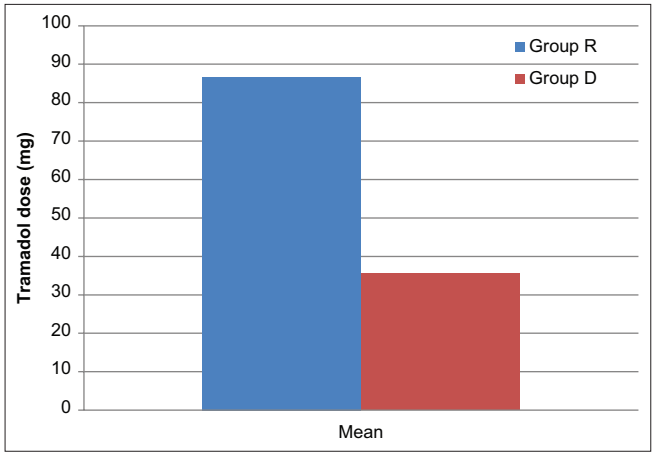

Fig. 1: Post-operative total tramadol required

Cardiac parameters (heart rate and blood pressure), SpO_2, and nausea were measured at the 1st, 2nd, 4th, 8th, 12th, and 24th h. Rescue analgesia with 50 mg of tramadol in 100 mL of normal saline was administered over 20 min at the patient's request or if the VAS was >44 mm. It can be done again after at least 4 h. Ondansetron 4 mg was given intravenously if vomiting or nausea was observed within 2 h.

Patients' pain was assessed and data collected in time until the first rescue analgesia, defined as the amount of tramadol required within 2 h after the end of the block and the total amount of rescue analgesia required. In addition, nausea scores were recorded using a categorical system (none-0, mild-1, moderate-2, and severe-3), as well as any other block or drug-related adverse effects. Pain scores were recorded separately at the indicated time intervals using the VAS score [6] as no pain (0–4 mm), mild pain (5–44 mm), and moderate pain (45–74 mm), or severe pain (75–100 mm).

Student t-tests for continuous variables and Chi-square tests for categorical variables were used to analyze patient characteristic data. Statistical analysis was performed with SPSS statistical program. $p<0.05$ was deemed significant.

RESULTS

Age, height, weight, body mass index, duration of surgery, and baseline vitals were comparable across the two groups (Table 1).

In comparison to Group D (19.04±4.20 h), time to first rescue analgesia was substantially shorter in Group R (11.62±3.80 h) ($p<0.001$) (Table 2).

As comparison to Group D (35.56±39.54 mg), Group R (86.67±30.55 mg) required considerably more tramadol overall during the post-operative period ($p<0.001$) (Table 2).

In Group R, four patients (8.9%) needed 150 mg of tramadol as complete analgesia in 24 h, compared to 16 patients (55.6%) who needed 50 mg, 100 mg, and 16 patients (55.6%) who needed 100 mg, respectively. While in Group D, 14 patients (48.9%) needed only 50 mg of tramadol, and four patients (11%) needed 100 mg of tramadol as the total amount of analgesia needed in 24 h, 12 patients (40%) had good pain relief with the block alone and did not need any additional analgesia in the first 24 h following surgery.

At 8 h, 12 h, and 24 h, patients in group R had VAS scores that were considerably higher than those in Group D (all values $p<0.001$). During 8 h, 12 h, and 24 h, the incidence of nausea was higher in Group R than in Group D ($p=0.18$); however, only at 8 h ($p=0.004$) and 12 h ($p=0.003$) was this difference statistically significant (Table 3).

Table 1: Sociodemographic variables of the study participants

Sociodemographic	Group R	Group D	p
Age	30.20±0.15	29.76±3.21	0.509
Weight	69.16±7.72	67.28±4.13	0.154
Height	159.96±3.87	161.29±4.24	0.123
BMI	27.08±3.72	25.83±2.15	0.053
Duration of surgery	47.56±7.20	45.44±5.62	0.125
Baseline heart rate	79.09±3.27	79.89±3.43	0.261
Baseline SpO2	99.33±0.83	99.20±0.79	0.435
Baseline SBP	126.71±5.78	127.93±3.76	0.237
Baseline DBP	78.29±4.20	78.98±4.10	0.433

BMI: Body mass index, SBP: Systolic blood pressure, DBP: Diastolic blood pressure

Table 2: Distribution of study participants as per need of analgesia

Time to first rescue analgesia	Group R	Group D	p
Mean time (h)	11.62±3.80	19.04±4.20	<0.001

Table 3: Nausea score

Time (h)	Nausea scores	Group R frequency	Group D frequency	P
At 1	0	30	30	
At 2	0	30	30	
At 4	0	30	30	
At 8	0	18	28	0.004
	1	3	2	
	2	9	0	
	3	0	0	
At 12	0	20	28	0.003
	1	9	2	
	2	1	0	
	3	0	0	
At 24	0	24	29	0.138
	1	5	1	
	2	1	0	
	3	0	0	

DISCUSSION

The use of dexamethasone as an adjuvant to LA in peripheral nerve blocks has been around for some time, but a thorough literature search found no studies using dexamethasone to improve the analgesic efficacy of TAP blocks with ropivacaine 0.1% in patients with LSCS. The aim of this study was to determine whether the addition of dexamethasone improves the analgesic quality and duration of ropivacaine.

Dexamethasone inhibits neuronal discharge and transmission in nociceptive C fibers to produce an analgesic effect. Compared with Group D (19.04±4.13 h), the time to the first rescue pain effect was significantly shorter in Group R (11.62±3.80 h) ($p<0.001$).

Another research Akkaya *et al*. [4], showed that when dexamethasone was added to levobupivacaine in an ultrasound-guided TAP block, the times requiring more pain medication were significantly longer in the dexamethasone group than the levobupivacaine group (13±7.8 h vs. 6.1±4.8 h, $p<0.001$).

A research Cummings *et al*. [5] demonstrated that dexamethasone extended analgesia more with ropivacaine than with bupivacaine (11.8% [9.7–13.8%] vs. 22.2 [18.0–28.6] h) and (14.8 [11.8–18.1%] vs. 22.4 [20.5–29.3] h), respectively, in interscalene block.

According to a research Shrestha *et al*. [3], the addition of 4–8 mg of dexamethasone to LA in brachial plexus block decreased the time it

took for analgesia to start acting and greatly increased its duration. In this trial, the average duration of analgesia with dexamethasone was 12–24 h, whereas with LA and adrenaline, it was just 4 h.

Therefore, the results of this study are consistent with other studies [7] that have shown that the addition of dexamethasone to LA reduces the time of onset of rescue analgesia, as so many research studies have used peripheral nerve blocks in place of fascial blocks.

At 1 h, 2 h, and 4 h after surgery, the differences in VAS scores between the two groups were not statistically significant. This is thought to be due to the spinal anesthesia administered to both groups, which is expected to reduce discomfort for up to 4 h per session. At 8 h, 12 h, and 24 h after surgery, the VAS scores in Group R were significantly higher than those in Group D, indicating that the addition of dexamethasone to ropivacaine in TAP block significantly reduced pain caused by both somatic and visceral components.

Meanwhile, one study Abdalla [8] reported that dexamethasone-bupivacaine had a significantly lower post-operative pain score than bupivacaine in TAP block patients undergoing radical cystectomy. In Group R, the VAS S score peaked at 12 h, while, in Group D, it peaked at 24 h in Group D, indicating that Group R patients reported somatic pain substantially earlier than Group D patients did. Compared to Group D (4.4% at 8 h, 4.4% at 12 h, and 2.2% at 24 h), Group R experienced considerably higher rates of nausea (28.9% at 8 h, 22.2% at 12 h, and 13.3% at 24 h).

This shows that the antiemetic effect of dexamethasone (8 mg) is due to a direct central action in the nucleus of the solitary tract, interacting with the neurotransmitter serotonin, and the receptor proteins tachykinin NK1 and NK2 and alpha-adrenaline, which maintains normal physiological functions of organs and organs systems, regulating the hypothalamic-pituitary-adrenal axis [9] after its systemic absorption.

Because the D group had better pain relief and used less tramadol, the nausea scores probably also decreased. This result was consistent with a study Huynh *et al.* [10,11] that showed that dexamethasone significantly reduced the incidence of PONV. Patients in both groups did not experience vomiting. This can be explained by the point that the study subject received 4 mg of ondansetron intravenously as soon as he felt tired.

The decrease in vomiting frequency in the two groups may be due to post-operative analgesia of TAP blockade in both groups. No blockade- or drug-related side effects, such as LA toxicity or surrounding visceral damage, were observed in either group.

CONCLUSION

In patients undergoing LSCS, the combination of dexamethasone and 0.1% ropivacaine prolongs the analgesic duration of TAP blockade. It also has opioid sparing and antiemetic properties that improve maternal satisfaction and post-operative recovery.

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AUTHORS CONTRIBUTIONS

All the authors have contributed equally.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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