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Dexamethasone added to levobupivacaine in ultrasound-guided tranversus abdominis plain block increased the duration of postoperative analgesia after caesarean section: a randomized, double blind, controlled trial

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Abstract. – OBJECTIVES: When added to local anaesthetics, dexamethasone can prolong the duration of peripheral blocks. Dexamethasone has a long and efficient glucocorticoid structure and presents anti-inflammatory properties. The aim of this study was to determine the effect of dexamethasone on the block duration added to levobupivacaine used for transversus abdominis block (TAP) applied to patients who underwent caesarean section.

PATIENTS AND METHODS: Forty-two patients with spinal anaesthesia in an American Society of Anesthesiologists (ASA) I-II risk group were included in the study and divided into two groups. Bilateral 30 ml 0.25% levobupivacaine and 2 ml 0.9% NaCl for the levobupivacaine group and bilateral 30 ml 0.25% levobupivacaine and 2 ml dexamethasone (8 mg) for the dexamethasone group were administered in a TAP block performed with ultrasonography.

The time need for the first analgesic in the postoperative period was recorded. The numeric evaluation scale, and the total additional analgesic amounts were recorded.

RESULTS: The time before the administration of the first additional analgesic dose was prolonged significantly in the dexamethasone group compared to the levobupivacaine group (p = 0.004). The pain scores were lower in the dexamethasone group for superficial pain. A significant difference for the dexamethasone group was observed in the evaluation of deep pain. The total consumption of tramadol was significantly lower in the dexamethasone group (p = 0.001).

CONCLUSIONS: The utilization of dexamethasone, which has a prolonging effect on the transversus abdominis plane block, may be an alternative to epidural opioid analgesia in caesarean section. We observed that dexamethasone added to levobupivacaine in a TAP block applied for analgesia following a caesarean section procedure prolonged the time required for analgesia.

Key Words:
Transversus abdominis plane block, Levobupivacaine, Dexamethasone, Caesarean section.

Introduction

Transversus abdominis area block (TAPB) performed in conjunction with ultrasonography (USG) for postoperative analgesia is more frequently used as an alternative modality in caesarean surgeries; different drug combinations have been explored to determine the most efficient analgesic combination[1,2]. The addition of adjuvant substances to the local anaesthetic drugs in TAPB and their efficiency have been studied[3]. The effect of local anaesthetic adjuvant substances may be increased to provide an effective and long-lasting nerve blockade[4].

Levobupivacaine is used as a local anaesthetic[5]. Dexamethasone has a long and efficient glucocorticoid structure and also offers anti-inflammatory properties. When added to local anaesthetics as an adjuvant in peripheral blocks, it increases the action time[6]. It may also prolong the analgesia time and contribute to the TAPB.

In our randomized and double-blind study, we analyzed the effects of dexamethasone in addition to levobupivacaine on postoperative analgesia time and the analgesic quality of ultrasound-

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guided TAPB. This study may enhance the possible analgesic modalities for postoperative pain control in caesarean section patients.

Patients and Methods

Between 10 April and 31 July 2012, 42 patients from 20 to 40 years of age with ASA I-II status who had an elective caesarean indication in The Obstetrics and Gynaecology Clinic were included in this study. Written informed consent was obtained from all participants. We received the ethical committee's approval for the study as decision number 2012/22 from the Ethical Committee of the Clinic Studies of the University of Izzet Baysal, Bolu, Turkey *Bolu.* Our study excluded patients who were subjected to other surgeries at the same time as the caesarean or those for whom emergency caesarean due to conditions such as myoma or placenta accreta was recommended. We also excluded pregnant patients with systemic cardiovascular and endocrine diseases, a body mass index higher than 30, any foetus pathology, a history of severe chronic pain, and hypersensitivity or allergy to any of the drugs to be used, as well as patients who were opioid-dependent, had a postoperative vomiting history, refused to take part in the study, or were contraindicated for spinal anaesthesia.

The patients were randomized and divided into two groups by a lay assistant who was not otherwise involved in the study who provided the randomization assignment in a sealed envelope before surgery. Information about the numeric rating scale (NRS_{10}) used for the evaluation of pain intensity and diversity (visceral/somatic) was given to each participant at the preoperative visit. The patients as well as the evaluating staff had no knowledge about the drugs administered. The evaluating staff members were trained in the proper method to obtain pain scores for both visceral and somatic pain. Visceral pain (described as a deep and generalised feeling) and somatic pain (explained as superficial and felt near the wound) were separately questioned in the pain evaluation. NRS_{10}-I for somatic pain and NRS_{10}-II scales for visceral pain were recorded. Routine electrocardiogram (ECG), heart rate (HR), mean arterial pressure (MAP), and oxygen saturation (SpO_2) were monitored for the patients who were taken to the operating room without premedication. Peripheral vascular access was established using an 18-20 gauge intravenous cannula. The patients were placed in a sitting position for the administration of 20 ml/kg prophylactic crystalloid fluid followed by spinal anaesthesia. After the patient was draped, spinal anaesthesia was administered using 0.5% bupivacaine 12.5 mg intrathecally to patients shorter than 160 cm at the level of L3-4 and 13.5 mg for patients taller than 160 cm using a 27-G "Quincke" tip spinal needle (Spinocan, Braun). After the anaesthesia was begun, the patient was turned 30 degrees to the "semi-fowler" position on the left side and to a 25-degree upright position from the waist; 4-6 litres/minute of oxygen were given to all patients until the end of the operation. Sensory and motor block levels were checked every two minutes, and the surgery began once a sufficient spinal block level (T7) had been reached. Demographic records and pertinent information (age of the mother, weight, height, smoking history, car sickness occurrence, previous surgeries, nausea after previous surgery, and previous delivery) were obtained from all patients.

After the surgery, the TAP block needle entry site was identified between the iliac crest and the costal margin. The area had been covered after skin disinfection. The probe was placed transversely on the skin, and musculus obliquus externus, obliquus internus, and transversus abdominis were stabilized at the ultrasonographic view. By using an in-plane technique, the position of the needle tip in the area between the M. obliquus internus and the M. transversus abdominis were observed by ultrasonography. The TAP blocks were performed using 100 mm 22-G block needles, 30 ml of 75 mg 0.25% levobupivacaine (Chirocaine 7.5 mg/ml, Abbott Laboratories, Istanbul, Turkey) + 2 ml normal saline (NS) by 32 ml for each side bilaterally for the levobupivacaine group (Group L), and 30 ml of 75 mg 0.25% levobupivacaine + 2 ml 8 mg dexamethasone phosphate (Dexamet 4 mg/ml, Osel, Istanbul, Turkey) by 32 ml for each side bilaterally in the dexamethasone group (Group D) were administered between the two muscles. During the injection, the distribution of local anaesthetics was observed as a hypoechoic enlargement upon ultrasonography.

At the 1^{st}, 2^{nd}, 4^{th}, 8^{th}, 16^{th}, and 24^{th} postoperative hours, mean arterial pressure (MAP), SpO_2 values, the time elapsed before the first analgesic request, NRS_{10} scale (NRS 0 = no pain, 10 = intolerable pain), and the total analgesic drug requirements were compared between the two groups. All measurements in this study were

done by the same assistant who was blinded to the groups and the drugs. The levels of motor block of the patients were evaluated using the Bromage scale. When the NRS_{10}-I and/or NRS_{10}-II reached > 4 by patient demand, 50 mg intravenous tramadol hydrochloride (Ultramex 2 ml/100 mg Adeka) were administered as needed in both groups. The patients were closely monitored, and any side effects of the anaesthetics as well as any surgical complications were recorded. The demographic data as average values and standard deviations are shown in Table I.

The primary outcome of the study was to evaluate the effect of dexamethasone on the time to the first request for additional analgesics. The pain scores and total analgesic consumption were chosen as secondary outcomes. Previous studies[7-10] have investigated the first analgesia times and the number of participants in terms of sample size analysis. The mean first analgesia time was determined to be five hours, and the standard deviation was three hours. To consider dexamethasone efficient, the analgesia time should be at least nine hours and the standard deviation should be four hours. These values have been used by G*Power (Kiel University, Germany) software to calculate the dimension with an α of 0.05 and a power rating of (1-β) 0.95. Although a result of 18 patients per group has been obtained in one-sided probability calculations, we aimed to start the study with a value of 21 per group and to perform a post-hoc power rating.

Statistical Analysis

The Statistical Package for the Social Sciences (SPSS Inc., Chicago, IL, USA) 16.0 was used to evaluate the results. *T*-test was used for groups with a normal distribution (Shapiro-Wilk test used), while chi-square and Mann-Whitney U tests were employed for those with abnormal distributions, respectively. The parametric values corresponding to a normal distribution are shown as average ± standard deviation (SD), while non-parametric values not corresponding to a normal distribution are shown as a median. The limit value of $p < 0.05$ was considered statistically significant.

Table I. Demographic data between groups (mean ± standard deviation).

Demographic data	Group	Mean ± SD (Median for ASA)
ASA	L	1
	D	1
Age	L	29.1 ± 4.3
	D	30.1 ± 4.1
Weight	L	72.9 ± 8.5
	D	77.5 ± 11.7
Height	L	161.6 ± 4.9
	D	159 ± 4.7

Results

After randomization, there were no exclusions or missing cases. No significant differences were observed among demographic data, ASA categorization, hemodynamic and respiratory parameters, car sickness, smoking rates, and multi-parity. The deep and superficial NRS_{10} values, total analgesic consumption, and time elapsed before requesting additional analgesics were significantly higher in favour of the dexamethasone group. The saving analgesic tramadol doses performed with mean and standard deviation were 92.9±36 in Group L and 50.0±35 mg in Group D. A significant difference was observed: $p = 0.001$.The motor block totally disappeared at the 4th hour, and the Bromage scale decreased to 0 for all patients. The mean time elapsed for the first analgesia, the standard deviation, the p-value, and the upper/lower confidence intervals are provided in Table II.

The values obtained for NRS_{10}-I results for somatic pain are shown in Figure 1, while Figure 2 depicts NRS_{10}-II results for visceral pain. The related p-values have been provided as footnotes. According to these results, a significant difference was present between the groups with a more pronounced difference for NRS_{10}-I. No complications or considerable nausea and vomiting associated with spinal anaesthesia or TAP block were seen in our study.

Table II. Time elapsed for the first analgesia request.

Group	N	Mean (hour) ± standard deviation [confidence interval]	*p*-value
L	21	6.1 ± 4.8 [3.9-8.2]	0.001
D	21	13 ± 7.8 [9.4-16.5]	

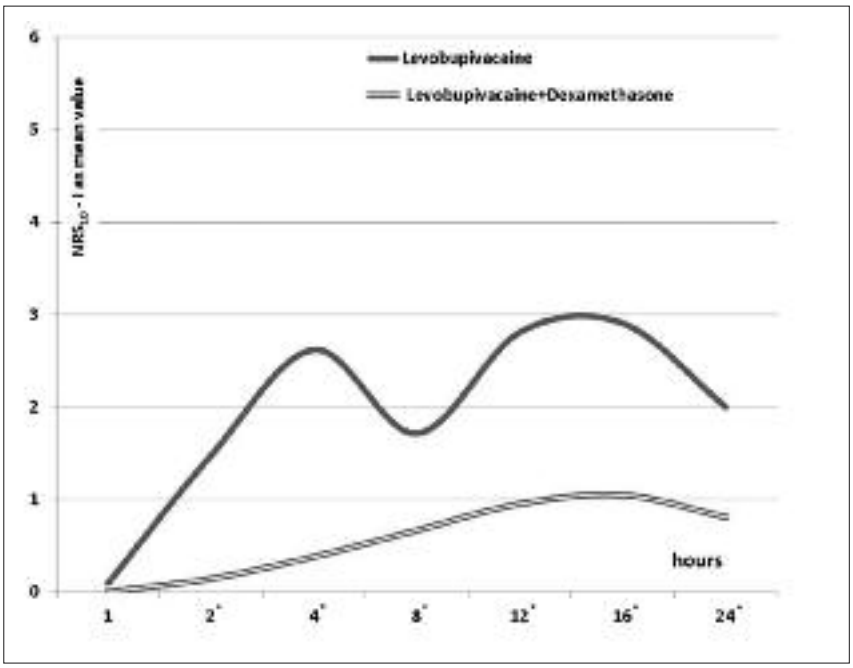

Figure 1. Progression of mean NRS10-I values for 24 hours. An asterisk indicates minutes with statistical significance. p-values for each measurement time were as follows: 0.152, 0.003, 0.002, 0.048, 0.203, 0.002, and 0.042, respectively, for the times given.

Discussion

When added as an adjuvant to local anaesthetics for different blocks and administration routes, dexamethasone was shown to extend the analgesia time. In a prospective, randomized, double-blind study performed on 72 patients by Naghipour et al[11], 8 mg dexamethasone administrated via the epidural method prolonged the analgesia time by two hours. Parrington et al[12] observed the same effect of dexamethasone in a block of the supra-clavicular brachial plexus as 104 minutes. In a study of Holte et al[13] on volunteer patients, dexamethasone was added to bupivacaine microcapsules by subcutaneous infiltration to obtain 50 μg in 10 ml, and a significant

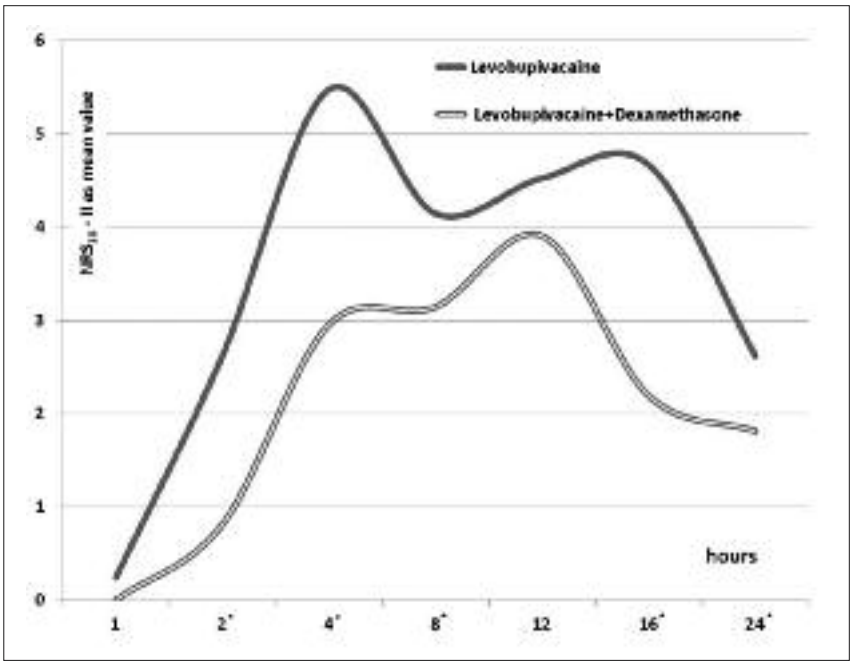

Figure 2. Progression of mean NRS10-II values for 24 hours. An asterisk indicates minutes with statistical significance. p-values for each measurement time were as follows: 0.152, 0.003, 0.002, 0.048, 0.203, 0.002, and 0.042, respectively, for the times given.

increase in analgesia time was observed. In our study, we evaluated the analgesia-time prolonging effect of the addition of dexamethasone to levobupivacaine in the transversus abdominis area and observed that this time increased.

The mechanisms of action, such as the increase of the local efficiency, slowdown of the absorption, and the systemic anti-inflammatory effect, of the analgesia-time prolonging effect of dexamethasone on levobupivacaine in TAPB still need to be investigated. Therefore, studies to define the increase of blood levobupivacaine should be undertaken.

The pain observed after obstetric surgeries can be caused by more than one anatomical structure; these different causes may be considered superficial and deep or visceral and somatic. All analgesic methods also may not show the same pain-relieving effect on different pain causes[14,15]. The wound infiltration effect on all somatic structures[16] or the effect of methods, such as TAPB, on visceral pain that causes deep pain sensations may not be expected to be efficient. In our study, visceral and somatic pain components were separated and a significant difference was observed between the two groups. However, while a significant difference was recorded for six measurements out of seven in our somatic pain evaluation, a significant difference was noted for only four measurements of seven in the visceral evaluation. In our study, the positive effect of an 8 mg dose of dexamethasone on visceral pain may be explained by the low but significant analgesic effect following systemic absorption[17,18].

Currently, the most efficient analgesia option after caesarean section is the epidural administration of opioids[19]. However, this method requires close monitoring for respiratory depression; many negative side effects, such as a decrease in motility[19], lumbago, complications associated with the utilization of a catheter, itching, nausea/vomiting, and a decrease of bowel movements[20], have also been observed[21,22] and discussed. One publication even stated that the epidural method is far from being a gold standard technique[23].

The number of publications regarding the efficiency of TAPB as an analgesic method in the postoperative period is increasing[2,24-27]. In a study by Mishriky et al[28], the opioid need decreased within the 12 hours after the TAPB. In Tan et al. s controlled, randomized study on 360 pregnant patients[29], they proposed that being discharged on the 1st or the 2nd day after a caesarean presents the same results for the mother and the baby. Studies about the positive effect of TAPB on early mobilisation and hospitalisation time still need to be carried out. The utilization of dexamethasone, which has a prolonging effect on the transversus abdominis area block, may be an alternative to opioid analgesia that can also aid in the recovery process.

Conclusions

We determined that the addition of dexamethasone to levobupivacaine in a transversus abdominis area block increased the analgesia time required for additional analgesia, decreased deep and superficial pain scores and led to a reduction of total additional analgesic substances required.

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Conflict of Interest

The Authors declare that there are no conflicts of interest.

Presentation

Preliminary data for this study were presented as an oral presentation at the Turkish Society of Anaesthesiologists' Congress 2012

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