Effect of Dexamethasone as an Additive to Ropivacaine on Duration of Ultrasound Guided Transversus Abdominis Plane Block in Cesarean Section under Spinal Anesthesia

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ABSTRACT

Introduction: Dexamethasone is increasingly used as a new adjunct to local anesthetics for prolonging the duration of action in Transversus Abdominis Plane (TAP) block. The aim of the study was to evaluate the effect of dexamethasone as an additive to 0.25% ropivacaine in duration of TAP block in patients undergoing cesarean section.

Objectives: To compare the effect of dexamethasone in transverse abdominal plane block with respect to its duration for postoperative analgesia in cesarean section under spinal anesthesia.

Methodology: This prospective cross sectional study was carried out at Birat Medical College Teaching Hospital among pregnant patients with American Society of Anesthesiologists(ASA)-II physical status undergoing elective caesarean section. The sample size was calculated to be 88 (44 in each group) and sample were collected using systemic random sampling technique. The parameters that were obtained were the time to first rescue analgesia request, total analgesia consumed, Numerical Rating scale score and incidence of nausea and vomiting in first 24 hr. After data collection, data were entered in a predetermined Performa and analysed with SPSS version 21.

Results: Time to first rescue analgesic administration was significantly prolonged in dexamethasone group (582.2 ±139.71 min) vs (135.0 ± 34.90 min) (P<0.001). Postoperative analgesics consumption was reduced in terms of doses of tramadol (130.68±24.62 mg) vs (50±0 mg) (P <0.001). NRS score was reduced in first 3-24 h postoperatively (P<0.001). No one in dexamethasone had nausea and vomiting.

Conclusion: Dexamethasone as an adjunct to ropivacaine in TAP block prolonged the duration of the block, decreased total analgesia consumption and decreased the incidence of post operative nausea and vomiting.

INTRODUCTION

Cesarean section (CS) is one of the most commonly performed surgical procedures worldwide, with millions of women undergoing this intervention annually.¹ Institutional births via a cesarean section is found to be as high as 45.81% in Nepal.² Effective pain management following CS is crucial not only for maternal comfort but also for facilitating early ambulation, breastfeeding and bonding with the newborn.³,⁴ Substantial pain and discomfort are anticipated after caesarean delivery hence, analgesic regimen should ensure effective and safe analgesia.⁵,⁶
Opioid and NSAIDS derivatives have been used to provide effective postoperative analgesia, but they are associated with nausea, vomiting, pruritus, urinary retention, gastritis and occasionally respiratory depression.7

Among the various analgesic delivery techniques utilized, ultrasound-guided transversus abdominis plane (TAP) block has gained significant attention for its efficacy in providing postoperative pain relief after CS under spinal anaesthesia.8 TAP block involves the injection of local anesthetics into the plane between the internal oblique and transversus abdominis muscles, effectively blocking the sensory innervation of the anterior abdominal wall between T10-L1.9

Ropivacaine, a long-acting local anesthetic, is commonly used for TAP block due to its favourable safety profile and duration of action.10 In a study conducted by Ahmed Z EL there was no significant difference in analgesic potency between ropivacaine 0.25% and 0.5% concentration.11

Study conducted by De Oliveira et. al. concluded that TAP blocks with ropivacaine 0.25% and 0.5% reduced pain, decreased opioid consumption, and provided earlier discharge ambulation that was associated with better quality of recovery.12

Higher concentration and large volume of LA produces prolonged duration of blockade but it increases susceptibility of pregnant women to local anesthesia toxicity. Therefore here we have used lower concentration of ropivacaine to provide analgesia. In order to enhance the duration and efficacy of TAP block additive are used to prolong postoperative analgesia. In a study conducted by Sharma UD and colleagues found that dexamethasone as an additive to ropivacaine in ultrasound guided TAP block significantly reduced pain and prolonged the duration of post-operative analgesia, and reducing post-operative analgesic consumption.13

Dexamethasone is potent glucocorticoid with analgesic, anti-inflammatory properties and antiemetic actions when used as an additive in peripheral nerve blocks, increasing the duration of analgesia and reducing postoperative nausea and vomiting (PONV).14, 15

Understanding the impact of this combination on postoperative pain scores, opioid consumption, maternal satisfaction, and potential adverse effects is crucial for optimizing pain management strategies in the obstetric population. Adding dexamethasone with ultrasound guided TAP block could potentially contribute to improving maternal outcomes and enhancing the overall experience of women undergoing caesarean delivery.

Hence this study was carried out to evaluate the effectiveness of dexamethasone as an additive to ropivacaine on the duration of analgesia in ultrasound-guided TAP block in patients undergoing elective LSCS under spinal anaesthesia.

**METHODODOLOGY**

This is a prospective comparative cross sectional study conducted in pregnant patient undergoing elective caesarean section at Birat medical college teaching hospital. This study was conducted after ethical clearance from Institutional Committee (Ref no IRC-PA-300/2023) at Birat medical college teaching hospital. The study period was from 20th April – 30th September 2023. ASA-II pregnant female undergoing elective caesarean section under spinal anesthesia were included in this study after taking written informed consent. The exclusion criteria included parturients with emergency caesarean section , refusing for procedure, with known allergy to LA/steroid, NSAIDS, infection at needle insertion side, history of chronic illness, recent use of glucocorticoids, pregnancy induced hypertension and BMI>30kg/m².

The sample size was calculated to be 88 (44 in each group). Systematic random sampling technique was used for sampling. It was calculated on the basis of study conducted by Jasleen Sachdeva 16 where mean time to first rescue analgesia in control group was found to be (3.11 ± 0.8)hr so if addition of dexamethasone prolongs time to rescue analgesia by 30 mins with alpha error of 5% and power of 80% sample size was 40 in each group. Assuming 10% drop out 44 cases were included in the study.

Statistical analysis was done by SPSS version 21. Quantitative data were expressed as mean ± standard deviation (SD) & Median, Interquartile range (IQR). Number or percentage were used to express qualitative data. In nonparametric data Mann Whitney z test was used for two-group comparisons. Analyses were two-tailed, P < 0.05 was considered statistically significant.

We hypothesized dexamethasone as an additive agent while performing ultrasound guided bilateral TAP block. Before surgery preoperative anaesthetic check-up of each patient was done. The patients were explained about the procedure and were educated preoperatively about how to report NRS pain scale as (NRS) (0 = no pain , mild pain (1-5) , moderate pain (6-7) and severe pain (8-10). On receiving the patient in the operative room, monitors including electrocardiography, pulse oximeter (SpO₂), and non-invasive blood pressure were connected and vital parameters were noted.

Under aseptic precaution spinal anaesthesia was given at sitting position with 0.5% heavy bupivacaine (2-3ml) according to height of patient.17 It was given at L3-L4 interspace with 25 Gauge Quincke after free flow of CSF. Intraoperatively any analgesic consumption were recorded.

Patient meeting inclusion criteria were shuffled into two groups A and B. First patient were chosen by asking them to pull one folded token among the two. Two tokens were prepared beforehand mentioning “Group A” or “Group B” on the inner side . The chosen token were unfolded to reveal which group they belong to.

The next patient were the next group whichever was excluded for the first patient. Patients meeting inclusion criteria were recruited two groups in alternating order thereafter. The injectate in both groups were prepared by an independent anaesthesiologist not involved in patient care, TAP performance or data collection.
Ultrasound guided TAP block was given to all patients after skin closure in operation theatre. TAP was administered by the posterior approach with Stimuplex Ultra 360 (B Braun) manufactured in Malaysia, 22G, 100 mm needle under ultrasound guidance. Linear array transducer probe (6–13 MHz Sonosite M-Turbo, Fujifilm USA) was used. One ml of normal saline (0.9%) was injected prior to LA injection to confirm the correct position of the needle tip. The same procedure was performed at the contralateral side and the patients were then transferred to the post-anesthesia care unit. The group were as follows:

Group A- USG guided TAP block with 0.25 % ropivacaine (n=44) 20 ml plus 1ml of 0.9% normal in each side.

Group B- USG guided TAP block with 0.25 % ropivacaine (n = 44) 20 ml plus 1ml (4mg) of dexamethasone in each side.

We used 0.25% ropivacaine 40 ml and also took care not to exceed the toxic dose which is,3 mg/kg. It was assessed hourly for first 4 hrs and then four hourly for first 24 hr. Whenever a patient requested for analgesia, NRS was assessed if it was 4 or more, rescue analgesia was administered with intravenous inj diclofenac 75mg. The time demand first rescue analgesia was noted. NRS > 3 after 30 mins of diclofenac 75mg – inj tramadol 100mg was given.

Total amount of cumulative rescue analgesia given was noted in first 24 hr: Nausea lasting more than 10 min and vomiting were treated with ondansetron 0.1mg/kg. The site of block was examined for evidence of hematoma, or signs of any other side effects related to TAP block at first 24h. All reports were entered in a predetermined proforma and analysed using SPSS version 21.

The primary objective was to compare the time to first rescue analgesia between group A and group B. The secondary objectives were to compare the total amount of rescue analgesia required in first 24 h postoperatively, severity of pain by NRS scale and incidence of nausea and vomiting between the two groups.

RESULTS

During the study period, total of 88 patients were analyzed based on whether they received dexamethasone as an additive with 0.25% Ropivacaine or normal saline at the end of the surgery after skin closure for postoperative analgesia. There was no statically significant difference between the two groups in terms of age, height, weight, BMI and gravidity (table 1).

Table 1: Demographics and Baseline vitals of study participants

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Group A (n=44)</th>
<th>Group B (n=44)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>26.02±4.10</td>
<td>26.02±4.29</td>
<td>0.83</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>62.93±6.23</td>
<td>65.65±6.12</td>
<td>0.04</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>160.2±6.98</td>
<td>162.13±7.64</td>
<td>0.21</td>
</tr>
<tr>
<td>BMI (kg/m2)</td>
<td>25.1±2.09</td>
<td>25.40±1.92</td>
<td>0.59</td>
</tr>
<tr>
<td>Gravida</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>One</td>
<td>31</td>
<td>29</td>
<td></td>
</tr>
<tr>
<td>Two</td>
<td>11</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>Three</td>
<td>2</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Duration of Surgery (min)</td>
<td>43.88±8.98</td>
<td>41.02±8.66</td>
<td>0.13</td>
</tr>
<tr>
<td>Baseline HR (bpm)</td>
<td>85.70±22.00</td>
<td>86.90±14.85</td>
<td>0.91</td>
</tr>
<tr>
<td>Baseline SBP (mmHg)</td>
<td>118.86±10.82</td>
<td>117.27±9.73</td>
<td>0.47</td>
</tr>
<tr>
<td>Baseline DBP (mmHg)</td>
<td>80.8±7.90</td>
<td>79.72±7.93</td>
<td>0.52</td>
</tr>
<tr>
<td>Baseline Spo2 (%)</td>
<td>98.90±2.52</td>
<td>99.20±1.06</td>
<td>0.47</td>
</tr>
</tbody>
</table>

Categorical variables as presented as a number and continuous variables are presented as mean ± standard deviation. P<0.05, statistically significant, SpO2-Peripheral capillary oxygen saturation, BMI-Body mass Index, HR-Heart Rate, SBP- Systolic Blood Pressure, DBP- Diastolic Blood Pressure. Group A: Transverse abdominis plane block without dexamethasone Group B: Transverse abdominis plane block with dexamethasone.

Postoperative analgesics consumption was reduced in terms of doses in Group B. Mean tramadol requirement for group B was (50 ± 0 mg) and for Group A was (130.68 ± 24.67 mg) which was significantly significant (P value <0.001). However diclofenac consumption were similar in both groups(table 2).
Data expressed as mean ± standard deviation. P<0.05, statistically significant

Group A: Transverse abdominis plane without dexamethasone

Group B: Transverse abdominis plane with dexamethasone.

None of the patient in group B reported nausea and whereas in group A 54.55% had nausea and no episode of vomiting in patients in either of the group.

Numeric Rating Scale score in group A was higher than group B from 3h to 24h which was significant. (P value <0.001) (table 3).

Table 3: Comparison of postoperative pain severity by numerical rating scale (NRS) score

<table>
<thead>
<tr>
<th>Time</th>
<th>Post operative pain severity score (NRS)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1h</td>
<td>1(0-1)</td>
<td>0.84</td>
</tr>
<tr>
<td>2h</td>
<td>2(0-3)</td>
<td>0.21</td>
</tr>
<tr>
<td>3h</td>
<td>5(3-5)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>4h</td>
<td>5(3-6)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>8h</td>
<td>5(3-5.5)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>12h</td>
<td>5(3-6)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>16h</td>
<td>3(2-3)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>20h</td>
<td>4(3-6)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>24hr</td>
<td>3(2-3)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Data expressed as median (Interquartile range) P<0.05, statistically significant

Group A: Transverse abdominis plane without dexamethasone

Group B: Transverse abdominis plane with dexamethasone.

DISCUSSIONS

All blocks performed were successful. Demographic characteristics and baseline vitals of study participants were comparable among both the groups (Table 1). In our study, dexamethasone as an additive to TAP block significantly decreased postoperative pain, reduced total analgesic consumption, and prolonged the time to first analgesic request in the postoperative period after elective cesarean section under spinal anesthesia. The difference in time to first analgesia request, pain severity and total 24hr analgesic consumption between groups was likely due to the perineural dexamethasone in the exposure variable.

Dexamethasone has been used as an adjuvant to LA in peripheral nerve blocks since long, but there are few literatures where dexamethasone has been used to augment the analgesic efficacy of TAP block with 0.25% ropivacaine in patients undergoing LSCS under spinal anesthesia.

Dexmethasone inhibits transmission and neural discharge in nociceptive C fibers exerting its analgesic action. Time to first analgesic administration (diclofenac) was significantly prolonged in Group B (582.27 ± 139.71 min) as compared to Group A (130.68 ± 24.62 min). A study found that addition of dexamethasone to ropivacaine in transversus abdominis plane block significantly prolonged analgesia (19.04 ± 4.13 h vs 11.62 ± 3.80h). This coincides with a study conducted by Sinha and Sachdeva where mean time to first analgesic requests was statistically significantly prolonged in dexamethasone group (5.92 ± 1.02 vs. 3.11 ± 0.82 h). A study conducted by K.C Cummings found that dexamethasone prolonged analgesia more with ropivacaine than with bupivacaine.

In contrary to our findings, a study done by Huang SH didn’t show a statistically significant difference in duration to first rescue analgesia. This might be due to block following general anesthesia in their case. In our case block is given after spinal anesthesia.

Our study showed statistically significant differences in NRS scores between two groups in first 3h-24h postoperatively. Similarly a study conducted by Ammar and Mahmoud also found VAS score was significantly lower at the postoperative 2 h (4.9 vs. 28.1, P=0.01), 4 h (12.2 vs. 31.1, P=0.01) and 12 h (15.7 vs. 25.4, P=0.02).

This correlates with a study by Raghukumar and Majigoudar which showed a higher VAS score in TAP alone and lower VAS score with perineural dexamethasone in TAP groups at 24th-hour postoperatively after cesarean delivery.

Study conducted by Kertalov A showed a statistically significant difference in the VAS scores between group I, group II and group III at all postoperative time points – 2 hr, 4 hr, 6 hr, 12 hr and 24 hr. (p < 0.00001).

There was a significantly reduced post-operative analgesic consumption (tramadol) in dexamethasone group when compared to the TAP only group in our study. Postoperative analgesics consumption was reduced in terms of doses in Group B. Mean tramadol requirement for group B was (50 ± 0 mg) and for Group A was (130.68 ± 24.67 mg) which was significantly significant (P value <0.001). In a study by Sharma Uma et al there was a decrement in total tramadol consumption in 24 h as compared to control group (223.33 ± 56.83 vs 293.33 ± 25.7, p < 0.001) but, this result is by much higher than our finding. This difference could be justified by the difference in population, study design, sample size, and surgical procedure (hernia repair surgery).
The use of systemic steroids as an antiemetic has been proven in the literature and is used in routine anesthesia practice. Steroids have been included in the antiemetic guidelines for chemotherapy-induced nausea and vomiting. A 4 mg of perineural dexamethasone halved the rate of postoperative nausea and vomiting in a study conducted by Zufferey. None of patients in group B had nausea probably owing to the better pain relief and reduced tramadol consumption in group B. Either of the group didn’t have episode of vomiting observed in patients of either group. This may be explained by administration of ranitidine and meclizine as a prophylaxis perioperatively. TAP block its postoperative analgesia action could also be the factor for the decreased incidence of vomiting in both the groups.

Therefore, results of our study are consistent with previous studies, whereby dexamethasone as an additive to LA reduces the time to first rescue analgesia, although most studies were performed with peripheral nerve block. Studies with addition of dexamethasone with 0.25% ropivacaine under spinal anesthesia are very few.

**CONCLUSION**

This study is consistent with previous studies, whereby addition of dexamethasone to ropivacaine prolongs time to first analgesia request. Addition of dexamethasone decreases postoperative analgesia consumption, provides better pain relief. No procedure or drug related side effects such as trauma to surrounding structures, haematoma or LA toxicity were reported in both the groups.

**LIMITATIONS OF THE STUDY**

- This study is limited to a single-centre and is not a randomised controlled study.
- The time to regression of spinal anaesthesia is different in different individuals that could have added to the analgesic efficacy of TAP block in the postoperative period.
- The study is limited to assessment of postoperative analgesia in first 24 postoperative hours. TAP block with dexamethasone has been demonstrated to produce clinically useful levels of analgesia for at least 48 h postoperatively.
- Some complications of dexamethasone like delayed wound healing, hyperglycaemia, and adrenal suppression were not evaluated. However, the studies done previously demonstrated a single small dose of dexamethasone is not associated with significant side effects.

**ACKNOWLEDGEMENTS**

We would like to acknowledge our study participants, colleagues and staff.

**CONFLICTS OF INTERESTS**

No conflicts of interest

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