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Effect of dexamethasone as an adjuvant with bupivacaine in transversus abdominis plane block for post-caesarean analgesia

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Abstract

Introduction: Regional anaesthesia, like transversus abdominis plane (TAP) block, are valuable adjuncts to multimodal analgesia; however, their optimal pharmacological combinations remain under investigation. This study evaluated the efficacy of adding dexamethasone to bupivacaine in TAP block for caesarean delivery.

Method: In this prospective, randomized, double-blind study, at Paropakar Maternity and Women's Hospital, Nepal, from Nov 2024 to Apr 2025, after ethical approval, 52 elective caesarean sections under spinal anaesthesia received bilateral TAP block with either bupivacaine alone (Group B, n=26) or bupivacaine plus dexamethasone (Group BD, n=26). Postoperative pain scores (NRS 0-10) at 2, 4, 6, 8, 12 and 24 hours, duration of analgesia, total opioid consumption, and adverse effects were analysed. Statistical analysis was performed with IBM SPSS v.24, for mean±SD or median (IQR) as appropriate, Mann-Whitney U test for non-normally distributed data, and Fisher's exact test for dichotomous outcome. Statistical significance was set at a two-tailed p-value <0.05.

Result: Group BD showed a significantly longer duration of analgesia than Group B (median 9.6 h [IQR 8.0–11.5] vs. 6.7 h [5.4–8.0], p<0.001). Pain scores were lower in Group BD at 6 hours (median 3 [2–3] vs. 4 [3–5], p=0.007). Ketorolac use did not differ significantly (p=0.105). Rescue pethidine was required in 7(26.9%) in Group B versus 1(3.8%) in Group BD (p=0.049). Nausea/vomiting occurred in 10(38.5%) vs. 2(7.7%) patients, respectively.

Conclusion: Adding dexamethasone to bupivacaine in TAP block significantly prolongs analgesia, reduces early postoperative pain and lowers opioid requirements in post-caesarean section patients.

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Introduction

Caesarean section is one of the most common surgical procedures worldwide.[1] Although it is considered a safe delivery option in various obstetric situations, like any other operative procedure, it is associated with significant postoperative pain.[2] Inadequately controlled pain, not only limits mobility, delays breastfeeding and disrupts sleep, but also can lead to chronic pain and thus reduce the long-term quality of life.[2–4]

In the era of multimodal analgesia, transversus abdominis plane (TAP) block is a proven technique incorporated in the management of postoperative pain after a caesarean section.[5] It works by directly delivering local anaesthetic to the nerves supplying the abdominal wall, providing targeted pain relief and also lowering the need for systemic opioids and their side effects.[6] Using ultrasound guidance has made TAP block administration even more accurate, effective, and safe.[7]

Despite its clear benefits, TAP block is still underutilized in many hospitals. This is mainly because the block has a limited duration of action, which primarily depends on the pharmacokinetics of the local anaesthetics used.[8] To extend this duration, various additives such as dexmedetomidine, clonidine and dexamethasone have been researched.[9–11] Dexamethasone appears particularly promising because of its anti-inflammatory effects and its potential to slow the absorption of local anaesthetics, thus prolonging the duration of block.[12] It has been used successfully as an adjuvant in peripheral nerve blocks for various surgeries. Evidence shows it can improve pain relief and reduce the need for opioids, though the results are not always consistent.[13–15]

The primary objective of this study was to evaluate whether adding dexamethasone to bupivacaine in the TAP block could prolong analgesia and improve pain control after a caesarean section. The secondary goals were to quantify opioid requirements within the first 24 hours after surgery and to compare the rates of complications like nausea, vomiting, and itching between the groups.

Method

This prospective, randomized, double-blind study was conducted at Paropakar Maternity and Women's Hospital, Kathmandu, over a five-month period (Nov 2024 to Apr 2025), after obtaining approval from the Institutional Review Committee (IRC). The study population was pregnant women scheduled for elective lower-segment caesarean section (LSCS) under spinal anaesthesia.

Exclusion criteria included contraindications to spinal anaesthesia, known allergy to the study drugs, significant medical comorbidities (such as diabetes mellitus, hypertensive disorders, hepatic or renal impairment), bleeding disorders, recent glucocorticoid or chronic opioid use, infection at the block site, antepartum or postpartum haemorrhage, intraoperative administration of opioids or steroids, and refusal to provide consent.

The sample size was calculated using data from literature[16] assuming a mean difference of 198 minutes and a standard deviation of 207.86 minutes, with an α=0.05 and a power of 90%. This yielded 23 patients per group; allowing for 10% dropout, 26 participants were enrolled in each group, for a total of 52.

Written informed consent was obtained from all participants after explaining the study protocol and the numerical rating scale (NRS) for pain assessment. Participants were then randomized by lottery into two equal groups.

- Group B (Bupivacaine only): bilateral TAP block with 0.25% bupivacaine, total volume 40 mL
- Group BD (Bupivacaine + dexamethasone): identical TAP block with the addition of 8 mg dexamethasone

The study solutions were prepared in two 20-mL syringes by an independent anaesthesiologist to maintain blinding of both patients and the outcome-assessing anaesthesiologist.

All patients received standard intravenous (IV) premedication with ranitidine 50 mg, metoclopramide 10 mg and cefazolin 1 g, and were preloaded with 10 mL/kg balanced salt solution. Spinal anaesthesia was administered with 1.8–2.0 mL of 0.5% hyperbaric bupivacaine, as per institutional protocol and discretion of the attending anaesthesiologist not involved in the study.

After completion of surgery, bilateral ultrasound-guided TAP block was performed using a linear ultrasound probe (6-13 MHz, Sonosite M-Turbo C) and a 22-G Quincke needle via the in-plane technique. Correct needle placement was confirmed by hydrodissection with 3 mL of normal saline between the internal oblique and transversus abdominis muscles.
All patients received intravenous paracetamol 1 g immediately after block placement and subsequently every six hours for 24 hours. Postoperative pain was assessed using the NRS at 2, 4, 6, 12 and 24 hours, along with monitoring of heart rate (HR), non-invasive blood pressure (NIBP) and oxygen saturation (SpO2). Rescue analgesia was initiated when the NRS pain score was ≥4 or upon patient request. Intravenous ketorolac 30 mg was administered as the first-line agent and repeated every 8 hours as required. If adequate analgesia was not achieved, intramuscular pethidine 50 mg combined with promethazine 25 mg was administered according to hospital protocol.

The primary outcome was the duration of analgesia, defined as the time from block to first rescue analgesia. Secondary outcomes included 24-hour opioid consumption and the incidence of adverse events (nausea, vomiting, and pruritus). Patients who required reoperation or developed postpartum haemorrhage were excluded from the final analysis.
Statistical analysis was performed with IBM SPSS v.24. Descriptive data are presented as mean±SD or median (interquartile range) as appropriate. The primary outcome (duration of analgesia) and ordinal pain scores (NRS), which were non-normally distributed, were analyzed using the non-parametric Mann-Whitney U test. Dichotomous secondary outcomes (e.g., pethidine requirement, adverse events) were compared using Fisher's exact test. Statistical significance was set at a two-tailed p-value <0.05.

Result

A total of 52 patients were recruited, 26 in each group. The groups were comparable with respect to age, weight, and duration of surgery, Table 1.

The median pain scores were generally lower in Group BD compared with Group B; however, the difference reached statistical significance only at 6 hours postoperatively (median NRS 3 [IQR 2–3] vs. 4 [3–5], p=0.007). At all the other time points (2, 4, 8, 12, and 24 hours), the differences were not statistically significant, Table 2.

The duration of analgesia was significantly longer in Group BD (median 9.6 h [IQR 8.0–11.5]) than in Group B (median 6.7 h [5.4–8.0], p<0.001), indicating enhanced postoperative analgesic effect in Group BD. This difference was statistically significant (Odds Ratio 0.11, 95% CI 0.01–0.96; p=0.049), Table 3.

The median ketorolac consumption was 30 mg (IQR 30-60) in Group B vs. 30 mg (IQR 30-52.5) in Group BD, p=0.105. Rescue analgesia with pethidine was required in 7 patients (26.9%) in Group B compared to 1 patient (3.8%) in Group BD. Fisher's exact test showed that the requirement was significantly higher in Group B (odds ratio 9.21, 95% CI 1.05–80.7, p=0.049), Table 3.

Nausea/vomiting occurred in 10 patients (38.5%) in Group B and 2 patients (7.7%) in Group BD. Pruritus was observed in none of the Groups.

Table 1. Clinico-demographics of patients in Group B (Bupivacaine only) and Group BD (Bupivacaine + dexamethasone) transversus abdominis plane (TAP) block for post-caesarean analgesia, n=52

Variable	Group B (n=26) mean±SD	Group BD (n=26) mean±SD	p-value t-test
Age (years)	28.32±3.22	29.42±3.76	0.257
Weight (Kg)	64.31±9.46	67.54±10.28	0.244
Duration of surgery (Minutes)	63.27±14.07	61.92±14.36	0.734

Table 2. Comparison of postoperative pain scores (NRS) at different time intervals between two groups of TAP block for post-caesarean analgesia, n=52

Time (hours)	Group B (n=26) Median (IQR)	Group BD (n=26) Median (IQR)	p-value
2 h	2(1–2)	1.5(1–2)	0.582
4 h	2(2–3)	2(2–3)	0.194
6 h	4(3–5)	3(2–3)	0.007
8 h	3(2–3)	3(2–3)	0.326
12 h	4(3–4)	3.5(3–4)	0.250
24 h	3(3–4)	3(3–3)	0.074

Data are presented as median (interquartile range, IQR). Mann–Whitney U test applied, p<0.05 considered statistically significant

Table 3. Duration of analgesia and total analgesic consumption in TAP block post-caesarean, n=52

Variables	Group B (n=26) Median (IQR) or n(%)	Group BD (n=26) Median (IQR) or n(%)	p-value (Mann-Whitney U)
Duration of analgesia (hours)	6.7(5.4–8.0)	9.6(8.0–11.5)	<0.001
Rescue ketorolac use (mg/24 h)	30(30-60)	30(30-52.5)	0.105
Pethidine requirement# (Yes/No)	7/19	1/25	0.049+

Data are presented as median (interquartile range), or number (percentage) or unless otherwise stated. #Pethidine requirement comparison: Odds Ratio=0.11, 95% Confidence Interval=0.01 to 0.96, p<0.05 considered statistically significant. + Fisher's exact test is used for categorical data

Discussion

This study found that adding dexamethasone to bupivacaine in TAP block significantly prolongs analgesia, reduces early postoperative pain and lowers opioid requirements in post-caesarean section patients.

The TAP block has really been a core component of multimodal analgesia in recent years.[17] Its popularity has triggered several studies on various adjuvants to improve the overall analgesia profile in patients undergoing abdominal surgeries. Our study found that adding 8 mg dexamethasone to bupivacaine in TAP block not only significantly prolonged the postoperative analgesia but also reduced the overall opioid consumption in patients undergoing elective caesarean sections.

The observed increase in median duration of analgesia, from 6.7 hours to 9.6 hours, marks a clinically significant finding, as it provides extended analgesia in the initial, most painful postoperative period. This, in turn helps in facilitation of early mobilization, breastfeeding as well as overall recovery profile. Our finding is consistent with another study where addition of dexamethasone to bupivacaine in TAP block in post-caesarean section prolonged the analgesia by more than 3 hours, and significantly decreased opioid consumption in the first 24 hours.[9] Similarly, study adding 8 mg of dexamethasone to bupivacaine observed that the duration of analgesia increased from 5.3 hours to 8.5 hours, as well as lower pain scores at 6, 12 and 24 hours postoperatively.[18] Our finding is further supported by a meta-analysis of nine randomized control trials (RCT) demonstrated that perineural dexamethasone significantly prolonged TAP block duration (mean difference of 2.98 hours), reduced pain scores at 2, 6 and 12 hours, lowered analgesic consumption and decreased nausea and vomiting in the first 24 hours after surgery.[19] Similarly, another meta-analysis of 575 patients

found decrease in VAS scores at 4, 6 and 12 hours, increased time to first rescue analgesia (mean difference 3.08 hours), reduced 24-hour opioid consumption, as well as lower incidence of nausea and vomiting.[14]

The mechanism for the observed prolongation of analgesia could be multifactorial. Locally, perineural dexamethasone is believed to induce vasoconstriction at the block site, thereby decreasing the systemic absorption of local anaesthetic. Furthermore, its potent anti-inflammatory action may not only decrease the synthesis of local inflammatory mediators, but also may reduce the sensitization of nociceptors, which is presumed to be a key component of post-operative hyperalgesia.[20,21]

Some studies, in contrast, have reported results with mixed or limited benefits. In a study, TAP block was performed with and without perineural dexamethasone in sixty patients undergoing laparoscopic cholecystectomy, and observed that there was no significant difference in rescue analgesia timing, pain scores or total analgesia consumption.[15] Similarly, a RCT evaluating the adjuvant effect of 8 mg dexamethasone to ropivacaine in TAP block, for inguinal hernia repair and spermatocelectomy, found no statistically significant prolongation of analgesia.[22] The reason for these discrepancies, could be the variations in surgeries and resultant differences in visceral pain. In surgeries with predominantly visceral pain in the postoperative period, the benefit of prolonging the somatic pain by TAP block might get masked.[23]

One of the most important findings of our study is the reduction in rescue pethidine requirement from 26.9% in the control group to 3.8% in dexamethasone group. This significant reduction in opioid requirement highlights the profound opioid sparing efficacy of dexamethasone added TAP block. This finding strongly supports the inclusion of this technique in the multimodal analgesia arsenal, consistent with the theme of enhanced recovery after surgery (ERAS) protocol in obstetrics. This also correlates strongly with our secondary finding: a marked lower incidence of nausea and vomiting in dexamethasone group (7.7%) vs. control group (38.5%). Although our research was not powered to detect statistically significant secondary outcomes, the observed trend is both clinically relevant and biologically plausible. Dexamethasone is itself a potent antiemetic, and its role in reducing the incidence of nausea and vomiting could either be a direct action, or indirectly by lowering the need of pethidine, a potent emetogen.[24] The absence of pruritus in both groups is not surprising, as it is more commonly associated with neuraxial opioids.

Interestingly, in our study, though pain scores are generally lowered at all intervals, it is significant only at the 6 hours postoperative mark. This precisely coincides with our institution's practice where patients are routinely mobilized at around 6 hours postpartum period, and it coincides with the regression of effect of bupivacaine. The timing suggests that dexamethasone plays a role in enhancing the duration of bupivacaine block, mitigating breakthrough pain during mobilization. This is in contrast to other RCTs and meta-analysis where significant differences were observed in various time frames especially at 4-, 12- and 24-hours postoperative periods.[14,18,19] The differences could be because of the multimodal analgesia regimen used in our study. All patients received regular paracetamol, as well as injection ketorolac as needed for breakthrough pain as a first-line agent. The equivalent consumption of non-opioid analgesic ketorolac, further supports the interpretation that the fundamental nature of pain once the block receded was similar, and the dexamethasone adjuvant only effectively delayed its onset.

Although the finding of this study has good clinical implications, we acknowledge several limitations. Being a single-centre study, it limits the generalization of the findings. Although the sample size was adequate for primary outcomes, it provides insufficient power to conclude significance of secondary outcomes. Large scale multicentre study will be essential to fully evaluate its value in obstetric anaesthesia practice. We also did not evaluate the long-term

impact of post-surgical pain and patient satisfaction scores, which could be valuable areas of future research.

Conclusion

Addition of dexamethasone to bupivacaine in ultrasound-guided TAP block significantly prolongs the duration of postoperative analgesia and reduces opioid consumption, thereby limiting the associated side effects. These findings strongly support the integration of dexamethasone into multimodal analgesia regimens for postpartum patients.

Author contribution

Conception, design: AD, MM; Data acquisition: AD, MM, UB; Data analysis, interpretation: AD; Drafting: AD, UB; Revision: AD, MM; Final approval of the version to be published: AD, MM, UB; Agreement to be accountable for all aspects of the work: ALL

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Conflict of interest

None

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Supplementary material

Data and supplementary material that support the findings of this study are available from the corresponding author upon reasonable request.

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