Content available at: https://www.ipinnovative.com/open-access-journals

Indian Journal of Clinical Anaesthesia

Journal homepage: www.ijca.in

Original Research Article

Analgesic effect of perineural dexamethasone on transversus abdominis plane block: A randomised controlled trial at a tertiary hospital in Ghana

Daniel Akwanfo Yaw Sottie[1], Ebenezer Owusu Darkwa[2]*, George Aryee[2], Raymond Essuman[2], Grace-Imelda Obeng Adjei[1], Robert Djagbletey[2]

[1]Dept. of Anaesthesiology, Intensive Care and Pain Medicine, Korle-Bu Teaching Hospital, Accra, Ghana
[2]Dept. of Anaesthesiology, University of Ghana Medical School, Accra, Ghana

Abstract

Background: Postoperative pain management remains a significant challenge after Caesarean delivery (CD), with many patients experiencing inadequate analgesia despite conventional methods. This is particularly concerning as uncontrolled pain can lead to increased opioid consumption, delayed recovery, and prolonged hospital stay. This study aimed to evaluate the analgesic efficacy of adding perineural dexamethasone to bupivacaine in ultrasound-guided transversus abdominis plane (TAP) blocks for patients undergoing CD under spinal anaesthesia.

Materials and Methods: In this prospective, randomized, double-blind study, 99 patients scheduled for elective CD under spinal anaesthesia were randomly allocated into three equal groups (n=33). Each participant received a bilateral TAP block with one of the following: bupivacaine (0.25%) plus dexamethasone (8 mg) [Group D], bupivacaine (0.25%) alone [Group B], or 0.9% saline [Group S]. Outcomes included the time to first analgesic request, postoperative opioid consumption, pain scores based on the Numerical Rating Scale (NRS), and patient satisfaction.

Results: A total of 92 patients completed the study. Group B showed a significantly longer duration before requesting analgesia compared to Group S (327.5 ± 98.7 vs. 256.5 ± 72.3 minutes; $p = 0.023$). The addition of dexamethasone in Group D further extended this duration (485.2 ± 143.0 minutes; $p < 0.001$). Both Groups B and D demonstrated a significant reduction in opioid consumption within the first 24 hours postoperatively compared to Group S ($p < 0.001$), with Group D requiring the least amount of opioids ($p < 0.001$).

Conclusion: Adding dexamethasone to bupivacaine-based TAP blocks significantly improves postoperative analgesia and reduces opioid consumption following Caesarean delivery, compared to bupivacaine alone or saline. This combination provides a clinically relevant benefit, reducing 24-hour pethidine consumption by approximately 70% compared to control, suggesting its potential role in optimizing postoperative pain management and enhancing recovery outcomes.

Keywords: Caesarean delivery, Postoperative analgesia, TAP block, Dexamethasone, Bupivacaine.

Received: 14-05-2025; **Accepted:** 20-08-2025; **Available Online**: 31-10-2025

1. Introduction

Caesarean delivery (CD) is the most common surgical procedure globally, accounting for about 18.6% of births worldwide and up to 11.4% of births in West Africa.[1] There has been an increasing trend in CD rates globally, and Ghana is no exception.[2,3] CD is a major surgery often associated with significant pain in the immediate postoperative period.[4] Research has also shown an increased risk of persistent pain following CD.[5-7] Postoperative pain management, including post-CD pain management in Ghanaian women, has been found to be less satisfactory.[8,9] The current post-CD pain management protocols at the study site rely on systemic and intrathecal opioids, intravenous paracetamol, and rectal diclofenac.

Adequate postoperative analgesia following CD is essential to facilitate early ambulation, improve maternal

Corresponding author: Ebenezer Owusu Darkwa
Email: eowusudarkwa@ug.edu.gh

https://doi.org/10.18231/j.ijca.11272.1759482477

comfort, support breastfeeding, and reduce postoperative morbidity.[10] Although systemic opioids are widely used for pain management in this context, their administration is frequently associated with undesirable effects, including nausea, vomiting, sedation, and, in severe cases, respiratory depression.[11,12] These limitations highlight the need for effective opioid-sparing strategies within multimodal analgesic protocols.

In recent years, the use of perineural analgesic techniques, such as the transversus abdominis plane (TAP) block, which targets thoracolumbar nerves supplying the anterolateral abdominal wall, has gained prominence in perioperative pain management following lower abdominal surgery.[13-18] TAP block is cost-effective, straightforward to administer, minimally burdensome for healthcare staff, and has been associated with enhanced patient satisfaction.[19-26] However, the duration of analgesia achieved with local anaesthetic alone in TAP block is often limited, resulting in a relatively early requirement for rescue opioid medication. To overcome this limitation, the use of adjuvant agents has been explored to prolong block duration and enhance analgesic efficacy.

Dexamethasone, a synthetic corticosteroid with anti-inflammatory and vasoconstrictive properties, has shown potential as a perineural adjuvant to bupivacaine, prolonging the action of local anaesthetics and reducing postoperative opioid requirements.[27,28] In Ghana, the optimization of postoperative pain management is particularly pertinent due to limited access to advanced regional anaesthesia techniques, inadequate availability of continuous analgesic delivery systems, and a high incidence of opioid-related adverse events in obstetric populations. Incorporating dexamethasone into TAP block regimens may offer a cost-effective and practical solution to improve pain control and minimize opioid consumption in this setting.

This study, therefore, aimed to expand the repertoire of postoperative analgesic options available to parturients undergoing Caesarean delivery by assessing the analgesic properties of dexamethasone as an adjuvant in ultrasound-guided bilateral TAP block.

2. Materials and Methods

This trial was prospective, randomized, and double-blind. The research was conducted at the Obstetrics Department of the Korle Bu Teaching Hospital (KBTH). The study was approved by the institutional review board of KBTH (protocol number: KBTH-IRB/0001/2020) with trial registration number PACTR202212811501503. Patients scheduled for elective CD under spinal anaesthesia, who met the eligibility criteria and provided informed consent, were enrolled in the trial. All prospective participants underwent a pre-operative assessment.

ASA II pregnant women aged 18-40 years at term, presenting for elective caesarean section through a Pfannenstiel incision, were included in the study. Patients with documented adverse reactions to local anaesthetics or glucocorticoids, diabetes mellitus, cardiovascular disease, fetal pathology, coagulation disorders, premedication with opioid or non-opioid analgesics, corticosteroids or NSAIDs, contraindications to spinal anaesthesia, and those requiring a repeat subarachnoid block or conversion to general anaesthesia were excluded.

Based on a study by Akkaya et al.,[29] the mean ± standard deviation for the duration of analgesia after an ultrasound-guided bilateral TAP block was 13 ± 7.8 hours when dexamethasone was added to a local anaesthetic and 6.1 ± 4.8 hours without dexamethasone. At a 95% confidence level and statistical power of 90%, with a 1:1:1 allocation ratio, the sample size of 27 per group was calculated to be adequate using the formula by Charan et al.[30]

$$n= [(Z_{\alpha/2}+Z_{\beta})^2 \cdot (2\sigma^2)]/\Delta^2$$

Where $Z_{\alpha/2}$ is the Z value for the desired confidence level (1.96 for 95% confidence), Z_{β} is the Z value for the desired power (0.84 for 80% power), σ^2 is the pooled variance, and Δ is the minimum difference in means to be detected. For a three-group study, the significance level α was adjusted using the Bonferroni correction, dividing the original significance level (0.05) by 3, resulting in a corrected significance level of 0.017 for pairwise comparisons.

Patients were randomly allocated to one of three groups: Group A, Group B, or Group C, through simple balloting without replacement by an independent investigator who was not involved in the study. Thirty-three ballots were labeled A, B, or C, folded, shuffled, and placed in an opaque sealed envelope. Recruited patients were asked to pick a ballot without replacement to determine their group assignment. This process was repeated until all ballots were used. Due to limited access to computer-based randomisation tools, a simple balloting technique was used. Sealed and opaque envelopes were employed to ensure allocation concealment and minimize selection bias, providing a practical and reliable method for random group assignment.

Blinding was maintained throughout the study. An independent investigator, who was not involved in patient management or data collection, prepared all study solutions. The drugs were drawn into identical, sterile, unlabeled syringes of equal volume to prevent identification of group allocation. Each syringe was coded according to the randomisation sequence and provided to the attending anaesthesia provider, who was unaware of its contents. Both patients and the anaesthesia team administering the TAP block remained blinded to group assignment, ensuring that allocation concealment was maintained until data analysis was completed. After data analysis, the group allocations were revealed: Group A received bilateral TAP block with 20

ml of 0.25% plain bupivacaine plus 4 mg dexamethasone on each side (D); Group B received bilateral TAP block with 20 ml of 0.25% plain bupivacaine alone on each side (B); and Group C received bilateral TAP block with 20 ml of saline on each side (S).

Upon arrival in the pre-anaesthetic area, vascular access was achieved using an 18-gauge peripheral intravenous cannula. Patients were preloaded with 1000 ml of Ringer's lactate solution before being transferred to the operating room bed, where they were positioned supine with a 15° left lateral tilt. Non-invasive blood pressure monitoring, continuous electrocardiogram, pulse oximetry, and temperature monitoring were established. Afterward, spinal anaesthesia was performed under strict aseptic conditions at the L3/L4 interspace using a G25 Whitacre spinal needle, with 2 ml of 0.5% heavy bupivacaine and 25 µg of fentanyl.

The blood pressure was measured before and immediately after the administration of the sub-arachnoid block. Monitoring was conducted at one-minute intervals for the first five minutes, followed by every three minutes for the next 15 minutes, and then every five minutes for the remainder of the surgical procedure. A minimum sensory block level of T6 was considered adequate before the initiation of surgery. During the procedure, all patients received 1 g of intravenous paracetamol, and 100 mg of rectal diclofenac was administered at the conclusion of surgery. Postoperative analgesia included intravenous paracetamol administered every 6 hours and rectal diclofenac every 12 hours. Following the caesarean delivery (CD), all patients underwent ultrasound-guided bilateral TAP blocks in the operating theatre using a study solution prepared and blinded by an independent investigator and administered by the attending anaesthesia provider.

The ultrasound-guided TAP block was performed using the Butterfly iQ ultrasound probe and a 100 mm BBraun Stimuplex® nerve block needle (B. Braun Melsungen AG, 34209 Melsungen, Germany). The lateral TAP block was performed with the patient in the supine position using the Butterfly iQ® Ultrasound-on-Chip™ portable probe (Butterfly Network Inc., USA) set to linear high-frequency mode (7–13 MHz). The transducer was positioned in the axial plane along the mid-axillary line between the costal margin and the iliac crest to identify the external oblique, internal oblique, and transversus abdominis muscle layers, as well as the fascial plane between the internal oblique and transversus abdominis muscles, which served as the target site for local anaesthetic deposition.

Under real-time ultrasound guidance, a block needle was inserted in-plane at the anterior axillary line, directed from lateral to medial in an anterior-to-posterior trajectory toward the target fascial plane. The needle insertion site for the lateral TAP block corresponded anatomically to the triangle of Petit. After confirming needle placement and negative aspiration for blood, the prepared injectate was administered in 5 ml aliquots with intermittent aspiration to avoid intravascular injection. The correct spread of the injectate was confirmed by observing hypoechoic separation of the fascial plane on ultrasound imaging. A high-frequency linear transducer (7–13 MHz) mode was used with a depth setting of 3–5 cm, adjusted to optimize visualization of the abdominal wall layers and needle tip trajectory throughout the procedure. Prior to performing the TAP block, 2 ml of 2% lidocaine was infiltrated at the site of the block needle insertion. The time of TAP block performance was noted as time zero.

Patients were then transported to the post-anaesthetic care unit, monitored, and discharged after 3 to 4 hours of meeting institutional discharge standards. A trained nurse in the post-anaesthetic care unit and the general ward recorded static and dynamic pain scores using the numerical rating scale (NRS). The nurse was blinded to the interventions received by the patients. Pain intensity was assessed under two conditions: static pain, defined as pain at rest without movement, and dynamic pain, defined as pain elicited during activities such as coughing, deep breathing, or mobilization. The static pain score was assessed with the patient lying supine and still with normal tidal breathing (at rest), while the dynamic pain score was assessed on coughing. Pain scores were recorded immediately on arrival in the recovery ward and repeated at 2, 6, 12, and 24 hours after the TAP block. The time from the execution of the TAP block to the first analgesic request was also noted.

Breakthrough postoperative pain was managed using intramuscular pethidine at a dose of 1.5 mg/kg, up to a maximum of 100 mg, administered at 4-hour intervals as needed in the post-anaesthesia care unit and upon discharge to the ward. The static NRS pain score at the time of analgesic request was recorded. The total amount of pethidine administered in the first 24 hours following surgery was also documented.

Patient satisfaction with postoperative pain reduction was evaluated at 24 hours using a 3-point scale (satisfied, neutral, and dissatisfied). [31] The time taken for patients to request analgesia following the TAP block was the study's primary outcome measure. Secondary outcome measures included the amount of opioid used, the static and dynamic NRS pain scores, and patient satisfaction with 24-hour postoperative analgesia.

2.1. Statistical analysis

Data was analyzed using IBM Statistical Product and Service Solution (SPSS) version 25. Age, weight, and BMI were summarized as mean and standard deviation. The mean time to request the first analgesic, the mean NRS pain score at the time of request, and the mean amount of opioid (pethidine) administered in the first 24 hours were compared among the three groups using one-way analysis of variance (ANOVA). The static and dynamic NRS pain scores, systolic and

diastolic blood pressure, mean arterial blood pressure, and oxygen saturation were compared among the three groups using repeated measures ANOVA. Tukey's honest significant difference test and Bonferroni test were employed as post hoc tests where necessary for the one-way ANOVA and repeated measures ANOVA, respectively. The chi-squared test was used to assess differences between the study groups with respect to participant satisfaction. Statistical significance was defined as a p-value <0.05.

3. Results

Ninety-nine (99) patients were successfully recruited and randomised into three groups of equal numbers each (33). However, 27, 33 and 32 patients completed the study in Groups D, S and B respectively as shown in the consort diagram (**Figure 1**).

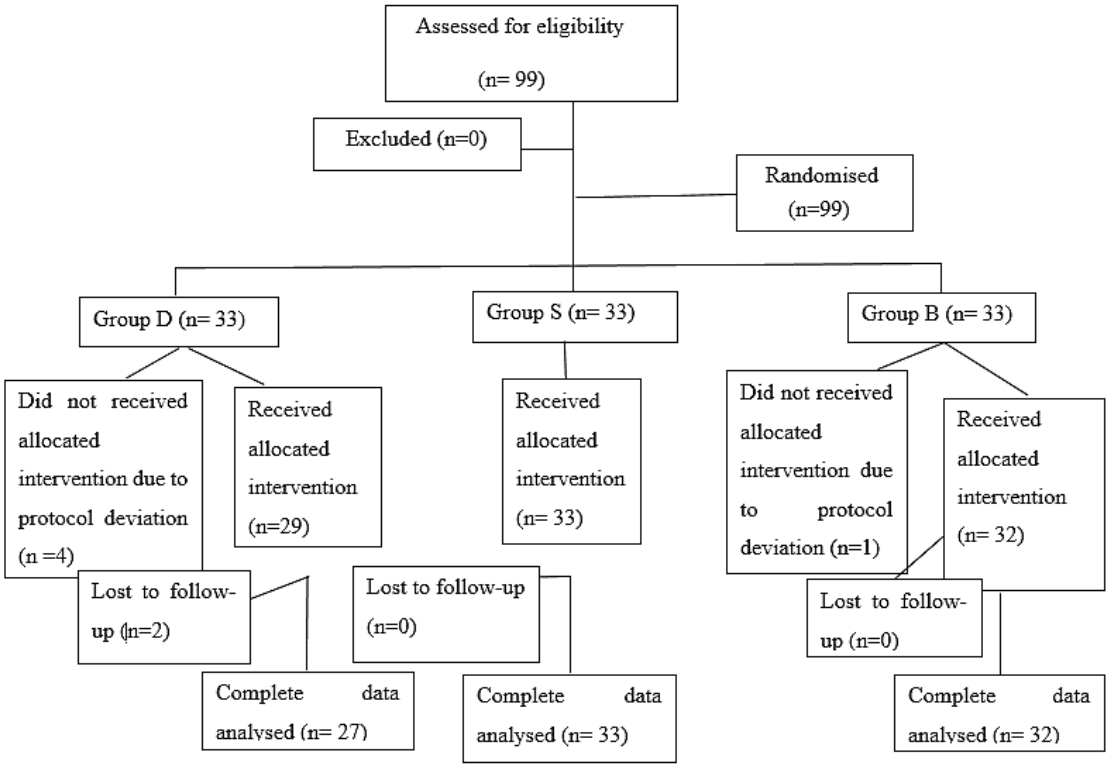

Figure 1: Consort diagram

The groups were similar in their demographic and clinical characteristics (**Table 1**).

Table 1: Baseline demographic and clinical characteristics compared between randomized groups

Variable	Group	Mean ± SD	*p*-value
Age (years)	Group D	30.9 ± 5.1	0.310
	Group B	29.3 ± 4.8	
	Group S	29.2 ± 4.8	
Weight (kg)	Group D	74.8 ± 9.0	0.751
	Group B	73.5 ± 6.5	
	Group S	73.8 ± 6.3	
Height (m)	Group D	1.60 ±0.06	0.752
	Group B	1.61 ±0.05	
	Group S	1.61 ±0.05	
Body Mass Index (kg/m^2)	Group D	28.9 ± 2.8	0.310
	Group B	28.3 ± 1.4	
	Group S	28.1 ± 1.8	
Parity	Group D	2.0 ± 1.0	0.694
	Group B	1.0 ± 0.7	
	Group S	1.0 ± 0.9	
Duration of Surgery (minutes)	Group D	62.0 ± 9.7	0.171
	Group B	59.4 ± 9.2	
	Group S	57.2 ± 11.7	

Table 1 Continued…			
Booking Systolic Blood Pressure (mmHg)	Group D	108.9 ± 8.6	0.125
	Group B	113.6 ± 9.2	
	Group S	111.2 ± 9.6	
Booking Diastolic Blood Pressure (mmHg)	Group D	67.7 ± 7.7	0.493
	Group B	68.8 ± 5.9	
	Group S	69.6 ± 6.0	

Table 2: Mean time to request for first analgesic and NRS pain score at time of request

Variable	Group		*p*-value
Mean time to request for first analgesic (minutes)	Group D	485.2 ± 143.0[b]	<0.001*
	Group B	327.5 ± 98.7[b]	
	Group S	256.5 ± 72.3[b]	
Post-hoc multiple comparison test	Group D v Group B	157.7(91.6-223.8)[a]	<0.001*
	Group D v Group S	228.7(163.1-294.3)[a]	<0.001*
	Group B v Group S	70.9(8.3-133.7)[a]	0.023*
NRS pain score at time of first analgesic request	Group D	5.2 ± 1.3/10[b]	0.879
	Group B	5.1 ± 1.3/10[b]	
	Group S	5.1 ± 0.9/10[b]	

**p*-value<0.05(statistically significant), [a] mean difference (95% CI),[b] Mean ± SD

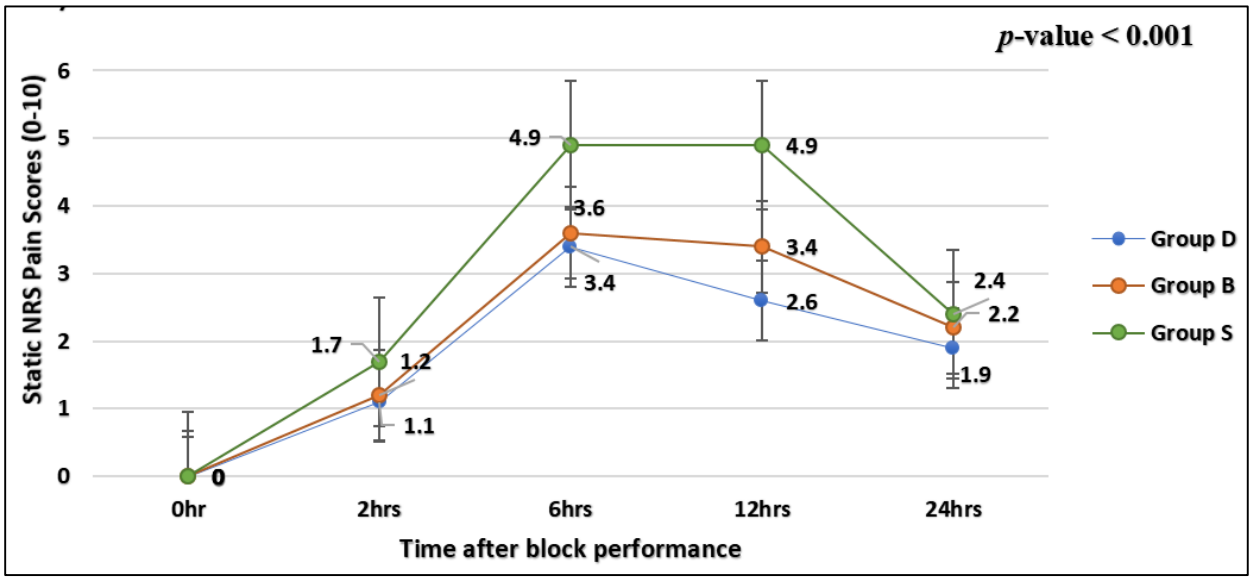

Figure 2: Pain scores at rest

The mean time to first analgesic request differed significantly among the three study groups (p < 0.001). It took a shorter time for group S patients to request for first analgesia, followed by group B patients and then group D patients. Post-hoc multiple comparison analysis demonstrated statistically significant differences in the mean time to first analgesic request between each pair of study groups. No statistically significant difference was observed in the pain scores at the time of first analgesic request (*p*-value = 0.879) (**Table 2**)

The NRS pain scores at rest differed significantly among the study groups (p < 0.001), with notable differences observed at 6 and 12 hours postoperatively (**Figure 2**). Post-hoc multiple comparison analysis at 6 hours post-surgery revealed significantly lower pain scores in Group D compared to Group S (p < 0.001), and in Group B compared to Group S (p = 0.001). At 12 hours postoperatively, Group D demonstrated significantly lower pain scores compared to both Group S (p < 0.001) and Group B (p = 0.022), while Group B also showed significantly lower pain scores compared to Group S (p < 0.001).

None of the participants reported pain during coughing at the time of TAP block administration. No statistically significant difference was observed in the changes of mean NRS pain scores among the three study groups during the first 24 hours post-surgery (p = 0.084) (**Figure 3**). However, inter-group comparisons at specific time points revealed significant differences in mean NRS pain scores during

coughing at 2 hours (p = 0.008), 6 hours (p = 0.001), and 12 hours (p < 0.001) postoperatively. Post-hoc analysis indicated that both intervention groups (Groups D and B) exhibited significantly lower pain scores compared to the control group (Group S) at these time points, whereas no significant differences were found between the two intervention groups themselves (**Table 3**).

There was a statistically significant difference between the mean amounts of pethidine required by the three study groups over first 24hrs after performance of TAP block (*p*-value < 0.001). Pairwise comparison showed a significantly lower pethidine consumption in Group D compared to Group B and Group S. Group B participants in turn also had significantly lower pethidine consumption compared to Group S (**Table 4**).

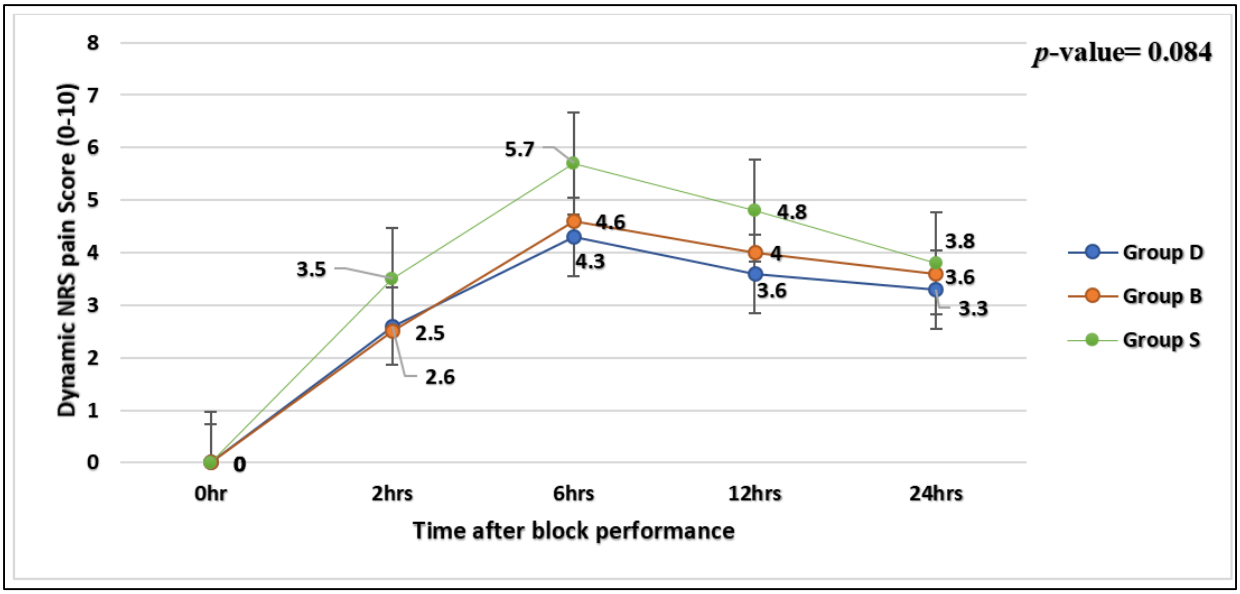

Figure 3: NRS pain scores on coughing

Table 3: Multiple pairwise comparison of mean NRS pain scores on coughing

Time	Group Pairing	Mean Difference	95% Confidence Interval		*p*-value
			Lower Bound	Upper Bound	
2 hours	Group D v Group B	0.152	-0.62	0.93	0.888
	Group D v Group S	-0.818	-1.59	-0.04	0.036*
	Group B v Group S	-0.970	-1.75	-0.19	0.010*
6 hours	Group D v Group B	-0.303	-1.25	0.64	0.726
	Group D v Group S	-1.424	-2.37	-0.48	0.002*
	Group B v Group S	-1.121	-2.07	-0.18	0.016*
12 hours	Group D v Group B	-0.455	-1.18	0.27	0.301
	Group D v Group S	-1.242	-1.97	-0.52	< 0.001*
	Group B v Group S	-0.788	-1.51	-0.06	0.030*

Table 4: Mean 24-hour pethidine consumption

	Group		*p*-value
Mean 24hr pethidine consumption(mg)	Group D	113.6 ± 81.58[b]	<0.001*
	Group B	269.1 ± 64.44[b]	
	Group S	380.6 ± 39.21[b]	
Post-hoc multiple comparison test	Group D v Group B	-155.5(-193.0– -117.9)[a]	<0.001*
	Group D v Group S	-267.0(-304.6– -229.4)[a]	<0.001*
	Group B v Group S	-111.5(-149.1– -73.9)[a]	<0.001*

A higher proportion of participants in Group D reported being satisfied (81.8%) compared to the other study groups (**Table 5**). The differences in satisfaction levels among the groups were statistically significant (p = 0.018). None of the participants reported being dissatisfied.

Table 5: Participant satisfaction

Variable	Group, n(%)			p-value
	D	B	S	
Neutral	6 (18.2)	8 (24.2)	16 (48.5)	0.018*
Satisfied	27 (81.8)	25 (75.8)	17 (51.5)	

*p-value<0.05(statistically significant)

4. Discussion

This study aimed to evaluate the analgesic efficacy of adding dexamethasone to bupivacaine in ultrasound-guided transversus abdominis plane (TAP) blocks for patients undergoing caesarean delivery. The results demonstrated significant improvements in postoperative pain management with the intervention, specifically in the time to first analgesic request and opioid consumption. The demographic characteristics were comparable across the three study groups, with no statistically significant differences observed.

Notably, the mean duration before the first analgesic request was significantly prolonged in the intervention groups compared to the control group. This result aligns with other studies in the literature.[22,23,32,33] TAP block with longer-acting local anaesthetics like bupivacaine provides targeted somatic analgesia by blocking the thoracolumbar nerves (T6–L1), which supply sensation to the anterior abdominal wall, the primary source of pain during caesarean section. This localized nerve blockade delays the onset of postoperative pain, thus increasing the time before analgesia is requested.[21,32] While studies report a prolongation in the time to first analgesic request, variations in methodology, local anaesthetic dosing, and the use of intrathecal opioids affect the magnitude of this benefit.[21,27,34,38] The benefit has been evident in studies where intrathecal bupivacaine alone or fentanyl was used as an adjuvant to bupivacaine for spinal block prior to the TAP block. However, when intrathecal morphine is used as an adjuvant, the additional analgesic benefit of the TAP block has been reported as reduced or not statistically significant.[38-40] These findings support the selective use of TAP blocks in tailored analgesia protocols, optimizing the block technique with careful choice of intrathecal adjuvants.

In our study, the time to request the first analgesic was significantly prolonged in the bupivacaine + dexamethasone group compared to the bupivacaine-only group (p-value < 0.001), a finding consistent with other clinical studies.[27,41] Evidence supports the role of perineural dexamethasone in prolonging the time to first rescue analgesia, improving postoperative pain control. Dexamethasone is believed to exert its analgesic effect through its anti-inflammatory action, reducing perineural oedema and the release of inflammatory mediators like prostaglandins, bradykinin, and cytokines. By dampening the local inflammatory response, dexamethasone reduces nociceptive transmission, prolonging sensory blockade. It also induces local vasoconstriction, reducing vascular uptake and systemic absorption of the local anaesthetic, thus maintaining higher concentrations at the target nerves. This leads to sustained sodium channel blockade and prolonged analgesia. Additionally, dexamethasone may modulate nociceptive C-fiber transmission, further enhancing analgesia.[42,43]

None of the patients reported pain (either at rest or during coughing) at the time of TAP block performance. Our results were consistent with those of Belzarena et al., who reported the duration of action of subarachnoid block with fentanyl as an adjunct lasting between 120 and 240 minutes.[44] Given that the mean duration of surgery in this study was approximately 60 minutes, the timing of the TAP block administration fell well within the effective duration of the spinal anaesthesia performed.

The mean Numerical Rating Scale (NRS) pain scores, both at rest and during coughing, were significantly higher in the control group compared to the two intervention groups across the 2 to 12-hour postoperative period. Although the group receiving bupivacaine with dexamethasone exhibited lower pain scores than the bupivacaine-only group, this difference was not statistically significant. These are consistent to findings of other studies.[20,22,25,26] However, Tan et al., did not find a significant difference in the NRS pain scores between intervention and control groups and attributed this to the use of morphine PCA in the study groups postoperatively.[24] The significantly lower pain scores observed in the intervention groups compared to control between the 2-12 postoperative hours in this study is of clinical importance. During this period, the spinal anaesthetic would have worn off and patients may be mobilising out of bed to care for the new born and this may result in increased pain being experienced.

Perineural dexamethasone has been employed as an adjunct to transversus abdominis plane (TAP) blocks in various surgical procedures, though without consistently demonstrating enhanced analgesic efficacy.[45] In the present study, the addition of dexamethasone to the TAP block was associated with lower NRS pain scores at rest and during coughing; however, the differences were not statistically significant. This finding is in contrast to those of Zemedkun et al.[46] and Aga et al.[47] A number of factors including the dose and route of administration of dexamethasone may explain the differences in the results. The actual mechanism of dexamethasone as an analgesic is still under investigation. Additionally, differences in the approaches to performance of TAP block and hence differences in groups of somatic nerves and dermatomes blockade may account for the differences in analgesic effect observed.

The trend of the pain scores over the first 24 hour postoperative period in this study revealed a rise in the pain scores at rest up to a peak at the 6-hour observation point in all study groups (**Figure 2**). On coughing, there was a rise in pain scores up to a peak of 6-hour observation point for groups D and B, and a peak of 12-hour observation point for group S (**Figure 3**). The trend in NRS scores noted above is similar to others reported in literature.[20,22] However, Kahsay et al. on the other hand demonstrated a steady decline of pain scores from 2 hours postoperatively down to the 24 hour observation point,[26] whereas Tan et al. found a decline of pain scores down to a nadir at the 6-12 hour time points for the control group before rising to the 24 hour time point.[24] The differences in findings may lie in the different study designs, differences in type, frequency and dosages of analgesics used in addition to TAP block, differences in the medications used for the TAP blocks and patient characteristics.

A number of studies have demonstrated the parenteral opioid sparing effect of TAP blocks when used as an analgesic modality following caesarean delivery.[46-48] The opioid sparing effect was found to be independent of the type and route of administration. From the present study, the difference in the mean amount of pethidine consumed by the intervention groups compared to the control as well as between the two intervention groups over 24 hours was statistically significant. This demonstrates the parenteral opioid sparing effect of TAP block when utilised as part of a multimodal analgesic regimen. The opioid sparing effect of dexamethasone may be due to its local and systemic effects once it is absorbed from the injection site.[49]

The results of this study, showing prolonged analgesia and reduced opioid use with perineural dexamethasone as an adjuvant to bupivacaine in TAP blocks, are not universally consistent with the literature. Wegner et al. found no significant difference in block duration or opioid consumption with dexamethasone in abdominal surgery.[45] Variability in dexamethasone dosing, surgical procedures, and techniques may account for these differing outcomes. These discrepancies highlight the need for further studies to determine the optimal dosing and clinical settings for dexamethasone in TAP blocks.

In the current study, 81.8% of participants in the dexamethasone group reported being satisfied with their postoperative analgesia, compared to 75.8% in the bupivacaine-only group and 51.5% in the control group. This difference in postoperative analgesia satisfaction level was significant, a finding similar to that of Sachdeva et al.[48] Maternal satisfaction after caesarean delivery is usually the outcome of a complex interplay of analgesic quality and absence of side effects such as nausea, vomiting and pruritus.

The results of this study suggests that incorporating dexamethasone as an adjuvant to TAP block may offer a clinically and economically advantageous strategy for postoperative pain management, particularly in low-resource settings. Dexamethasone is inexpensive and widely accessible, with an approximate cost of $0.21 for an 8 mg dose, compared to $5.25 for 100 mg of pethidine. By significantly reducing opioid consumption, dexamethasone not only enhances the quality and duration of analgesia but also decreases reliance on costly opioids and minimizes associated adverse effects. These findings indicate that dexamethasone could provide a cost-effective, scalable approach to optimizing postoperative pain control following caesarean delivery in resource-limited healthcare systems.

5. Limitation

A potential limitation of this study is the lack of standardisation in surgical technique, as procedures were performed by multiple surgeons. Variations in operative approach, tissue handling, and haemostatic practices may have influenced postoperative nociceptive input, potentially confounding pain assessment and analgesic requirements. Future research employing single-surgeon cohorts or stricter intraoperative standardization protocols may help reduce this variability and allow for a more accurate evaluation of the analgesic effects of dexamethasone as an adjuvant to TAP block.

6. Conclusions

Bilateral TAP block post-caesarean delivery significantly prolongs the time to first rescue analgesia and reduces opioid consumption compared to control. The addition of 8 mg of dexamethasone to the TAP block significantly extends the duration to first rescue analgesic request and contributes to a reduction in opioid consumption. Bilateral TAP block following caesarean delivery is associated with significantly lower NRS pain scores at rest and during coughing, as well as higher patient satisfaction compared to the control group.

7. Availability of Data and Materials

The datasets generated and analysed during the current study are available from the corresponding author upon reasonable request.

8. Source of Funding

This study was self-funded.

9. Conflict of Interests

The authors declare no conflict of interests.

10. Authors' contributions

DAYS, EOD, and RD developed the concept and writing of the manuscript. RE and GA analysed the data. GIOA contributed to the writing and review of different sections of the manuscript. Prior to submission, all the authors were involved in the review of the final manuscript. DAYS, EOD, and RD contributed equally to the manuscript.

11. Acknowledgement

We would like to thank the entire team of the Department of Anaesthesia at Korle-Bu Teaching Hospital for their invaluable support during the conduct of this study.

References

1. Betrán AP, Ye J, Moller A-B, Zhang J, Gülmezoglu AM, Torloni MR. The Increasing Trend in Caesarean Section Rates: Global, Regional and National Estimates: 1990-2014. *PLoS One*. 2016;11(2):e0148343. https://doi.org/10.1371/journal.pone.0148343.
2. Ghana Statistiscal Services (GSS), Ghana Health Service (GHS), ICF International. Ghana Demographic and Health Survey (GDHS). Demographic and Health Survey 2014. Rockville, Maryland, USA: GSS, GHS, and ICF International; 2015. 1–530 p.
3. Gulati D, Hjelde GI. Indications for cesarean sections at Korle bu teaching hospital, Ghana. 2012; Available from: https://core.ac.uk/download/pdf/30876953.pdf
4. Dolin SJ, Cashman JN, Bland JM. Effectiveness of acute postoperative pain management: I. Evidence from published data. *Br J Anaesth.* 2002;89(3):409–23.
5. Hannah ME, Whyte H, Hannah WJ, Hewson S, Amankwah K, Cheng M, et al. Maternal outcomes at 2 years after planned cesarean section versus planned vaginal birth for breech presentation at term: The international randomized Term Breech Trial. *Am J Obstet Gynecol*. 2004;191(3):917–27. https://doi.org/10.1016/j.ajog.2004.08.004.
6. Nikolajsen L, Sørensen HC, Jensen TS, Kehlet H. Chronic pain following Caesarean section. *Acta Anaesthesiol Scand.* 2004;48(1):111–6. https://doi.org/10.1111/j.1399-6576.2004.00271.x.
7. Eisenach JC, Pan PH, Smiley R, Lavand'homme P, Landau R, Houle TT. Severity of acute pain after childbirth, but not type of delivery, predicts persistent pain and postpartum depression. *Pain.* 2008;140(1):87–94. https://doi.org/10.1016/j.pain.2008.07.011.
8. Clegg Lamptey J, Hodasi W. An audit of aspects of informed consent and pain relief in general surgical units of Korle Bu Teaching Hospital. *Ghana Med J.* 2006;39(2):63–7. https://doi.org/10.4314/gmj.v39i2.35984
9. Danso K, Schwandt H, Turpin C, Seffah J, Samba A, Hindin M. Preference of ghanaian women for vaginal or caesarean delivery postpartum. *Ghana Med J.* 2009;43(1):29–33.
10. Pyati S, Gan TJ. Perioperative pain management. *CNS Drugs*. 2007;21(3):185–211. https://doi.org/10.2165/00023210-200721030-00002.
11. Madadi P, Ross CJD, Hayden MR, Carleton BC, Gaedigk A, Leeder JS, et al. Pharmacogenetics of neonatal opioid toxicity following maternal use of codeine during breastfeeding: A case-control study. *Clin Pharmacol Ther*. 2009;85(1):31–5. https://doi.org/10.1038/clpt.2008.157.
12. Angle P, Halpern S, Leighton B, Szalai J, Gnanendran K, Kronberg J. A randomized controlled trial examining the effect of naproxen on analgesia during the second day after cesarean delivery. *Anesth Analg*. 2002;95(3):741–5. https://doi.org/10.1097/00000539-200209000-00038.
13. Marhofer P, Harrop-Griffiths W, Willschke H, Kirchmair L. Fifteen years of ultrasound guidance in regional anaesthesia: Part 2 - Recent developments in block techniques. *Br J Anaesth.* 2010;104(6):673–83. https://doi.org/10.1093/bja/aeq086.
14. Bonnet F, Berger J, Aveline C. Transversus abdominis plane block: What is its role in postoperative analgesia? *Br J Anaesth.* 2009;103(4):468–70. https://doi.org/10.1093/bja/aep243.
15. Petersen PL, Mathiesen O, Torup H, Dahl JB. The transversus abdominis plane block: A valuable option for postoperative analgesia? A topical review. *Acta Anaesthesiol Scand.* 2010;54(5):529–35. https://doi.org/10.1111/j.1399-6576.2010.02215.x.
16. Pollock RE, Lotzova E, Stanford SD. Mechanism of Surgical Stress Impairment of Human Perioperative Natural Killer Cell Cytotoxicity. *Arch Surg.* 1991;126(3):338–42. https://doi.org/10.1001/archsurg.1991.01410270082013.
17. Lennard TWJ, Shenton BK, Borzotta A, Donnelly PK, White M, Gerrie LM, et al. The influence of surgical operations on components of the human immune system. *Br J Surg*. 1985;72(10):771–6. https://doi.org/10.1002/bjs.1800721002.
18. Ramsay MA. Acute Postoperative Pain Management. *BUMC Proc.* 2000;13(3):244–7. https://doi.org/10.1080/08998280.2000.11927683.
19. McDonnell NJ, Keating ML, Muchatuta NA, Pavy TJG, Paech MJ. Analgesia after caesarean delivery. *Anaesth Intensive Care*. 2009;37(4):539–51. https://doi.org/10.1177/0310057X0903700418.
20. McDonnell JG, Curley G, Carney J, Benton A, Costello J, Maharaj CH, et al. The analgesic efficacy of transversus abdominis plane block after cesarean delivery: A randomized controlled trial. *Anesth Analg.* 2008;106(1):186–91. https://doi.org/10.1213/01.ane.0000290294.64090.f3.
21. Baaj JM, Alsatli RA, Majaj HA, Babay ZA, Thallaj AK. Efficacy of ultrasound-guided transversus abdominis plane (TAP) block for post-cesarean section delivery analgesia: A double-blind, placebo-controlled, randomized study. *Middle East J Anesthesiol.* 2010;20(6):821–6.
22. Eslamian L, Jalili Z, Jamal A, Marsoosi V, Movafegh A. Transversus abdominis plane block reduces postoperative pain intensity and analgesic consumption in elective cesarean delivery under general anesthesia. *J Anesth*. 2012;26(3):334–8. https://doi.org/10.1007/s00540 -012-1336-3.
23. Alemnew EF, Lemma DT. Analgesic effectiveness of transversus abdominis plane block versus wound site infiltration after cesarean delivery under spinal anesthesia at Debre Tabor General Hospital, Debre Tabor, Ethiopia: A prospective cohort study, 2019. *Int J Surg Open*. 2020;23:17–22. https://doi.org/10.1016/j.ijso.2020.01.004
24. Tan TT, Teoh WHL, Woo DCM, Ocampo CE, Shah MK, Sia ATH. A randomised trial of the analgesic efficacy of ultrasoundguided transversus abdominis plane block after caesarean delivery under general anaesthesia. *Eur J Anaesthesiol.* 2012;29(2):88–94. https://doi.org/10.1097/EJA.0b013e32834f015f.
25. Kagwa S, Hoeft MA, Firth PG, Ttendo S, Modest VE. Ultrasound guided transversus abdominis plane versus sham blocks after caesarean section in an Ugandan village hospital: a prospective, randomised, double-blinded, single-centre study. *Lancet.* 2015;385:S36. https://doi.org/10.1016/S0140-6736(15)60831-5.
26. Kahsay DT, Elsholz W, Bahta HZ. Transversus abdominis plane block after Caesarean section in an area with limited resources. *South Afr J Anaesth Analg.* 2017;23(4):90–5. https://doi.org/10.1080/22201181.2017.1349361.
27. Ammar AS, Mahmoud KM. Effect of adding dexamethasone to bupivacaine on transversus abdominis plane block for abdominal hysterectomy: A prospective randomized controlled trial. *Saudi J Anaesth.* 2012;6(3):229–33. https://doi.org/10.4103/1658-354X.101213.
28. De Oliveira GS, Castro-Alves LJS, Ahmad S, Kendall MC, McCarthy RJ. Dexamethasone to prevent postoperative nausea and vomiting: An updated meta-analysis of randomized controlled trials. *Anesth Analg.* 2013;116(1):58–74. https://doi.org/10.1213/ANE.0b013e31826f0a0a.
29. Akkaya A, Yildiz I, Tekelioglu UY, Demirhan A, Bayir H, Ozlu T, et al. 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. *Eur Rev Med Pharmacol Sci.* 2014;18(5):717–22.
30. Charan J, Biswas T. How to calculate sample size for different study designs in medical research? *Indian J Psychol Med.* 2013;35(2):121–6. https://doi.org/10.4103/0253-7176.116232.

31. Boone HN, Boone DA. Analyzing likert data. *J Ext.* 2012;50(2):48. https://doi.org/10.34068/joe.50.02.48
32. McDonnell JG, O'Donnell B, Curley G, Heffernan A, Power C, Laffey JG. The analgesic efficacy of transversus abdominis plane block after abdominal surgery: A prospective randomized controlled trial. *Anesth Analg.* 2007;104(1):193–7. https://doi.org/10.1213/01.ane.0000250223.49963.0f.
33. Jadon A, Jain P, Chakraborty S, Motaka M, Parida SS, Sinha N, et al. Role of ultrasound guided transversus abdominis plane block as a component of multimodal analgesic regimen for lower segment caesarean section: A randomized double blind clinical study. *BMC Anesthesiol.* 2018;18(1):53–60.
34. Carney J, McDonnell JG, Ochana A, Bhinder R, Laffey JG. The transversus abdominis plane block provides effective postoperative analgesia in patients undergoing total abdominal hysterectomy. *Anesth Analg.* 2008;107(6):2056–60. https://doi.org/10.1186/s12871-018-0512-x
35. Tran TMN, Ivanusic JJ, Hebbard P, Barrington MJ. Determination of spread of injectate after ultrasound-guided transversus abdominis plane block: A cadaveric study. *Br J Anaesth.* 2009;102(1):123–7. https://doi.org/10.1093/bja/aen344.
36. Abdallah FW, Halpern SH, Margarido CB. Transversus abdominis plane block for postoperative analgesia after Caesarean delivery performed under spinal anaesthesia? A systematic review and meta-analysis. *Br J Anaesth.* 2012;109(5):679–87. https://doi.org/10.1093/bja/aes279.
37. Hebbard P, Fujiwara Y, Shibata Y, Royse C. Ultrasound-guided transversus abdominis plane (TAP) block. *Aneath Intensive Care.* 2007;35(4):616–7.
38. Charlton S, Cyna AM, Middleton P, Griffiths JD. Perioperative transversus abdominis plane (TAP) blocks for analgesia after abdominal surgery. *Cochrane Database Syst Rev*. 2010;(12):CD007705. https://doi.org/10.1002/14651858.CD007705.pub2.
39. Belavy D, Cowlishaw PJ, Howes M, Phillips F. Ultrasound-guided transversus abdominis plane block for analgesia after Caesarean delivery. *Br J Anaesth.* 2009;103(5):726–30. https://doi.org/10.1093/bja/aep235.
40. Abdallah FW, Chan VW, Brull R. Transversus abdominis plane block: A systematic review. *Reg Anesth Pain Med*. 2012;37(2):193–209. https://doi.org/10.1097/AAP.0b013e3182429531.
41. Zhang D, Zhou C, Wei D, Ge L, Li Q. Dexamethasone added to local anesthetics in ultrasound-guided transversus abdominis plain (TAP) block for analgesia after abdominal surgery: A systematic review and meta-analysis of randomized controlled trials. *PLoS One*. 2019;14(1):e0209646. https://doi.org/10.1371/journal.pone.0209646.
42. Choi S, Rodseth R, McCartney CJL. Effects of dexamethasone as a local anaesthetic adjuvant for brachial plexus block: A systematic review and meta-analysis of randomized trials. *Br J Anaesth*. 2014;112(3):427–39. https://doi.org/10.1093/bja/aet417.
43. Movafegh A, Razazian M, Hajimaohamadi F, Meysamie A. Dexamethasone added to lidocaine prolongs axillary brachial plexus blockade. *Anesth Analg.* 2006;102(1):263–7. https://doi.org/10.1213/01.ane.0000189055.06729.0a.
44. Belzarena SD. Clinical effects of intrathecally administered fentanyl in patients undergoing cesarean section. *Anesth Analg.* 1992;74(5):653–7. https://doi.org/10.1213/00000539-199205000-00006.
45. Wegner RC, Akwar D, Guzman-Reyes S, Pednekar G, Chaudhry R, Grewal N, et al. Evaluating the adjuvant effect of dexamethasone to ropivacaine in transversus abdominis plane block for inguinal hernia repair and spermatocelectomy: A randomized controlled trial. *Pain Physician.* 2017;20(5):413–8.
46. Zemedkun A, Admasu W, Jemal B, Abiy S, Mola S, Mulugeta H. Effectiveness of perineural and intravenous dexamethasone added to bupivacaine for transversus abdominis plane block in post-cesarean delivery pain control: A prospective cohort study. *Int J Surg Open*. 2020;24:143–50. https://doi.org/10.1016/j.ijso.2020.05.012
47. Aga A, Abrar M, Ashebir Z, Seifu A, Zewdu D, Teshome D. The use of perineural dexamethasone and transverse abdominal plane block for postoperative analgesia in cesarean section operations under spinal anesthesia: an observational study. *BMC Anesthesiol.* 2021;21(1):292–9. https://doi.org/10.1186/s12871-021-01513-4.
48. Sachdeva J, Sinha A. Randomized controlled trial to study the effect of dexamethasone as additive to ropivacaine on duration of ultrasound-guided transversus abdominis plane block in cesarean section. *Indian J Pain.* 2016;30(3):181–5. https://doi.org/10.4103/0970-5333.198056.
49. Hussain N, Van den Langenbergh T, Sermer C, Fontes ML, Atrey A, Shaparin N, et al. Equivalent analgesic effectiveness between perineural and intravenous dexamethasone as adjuvants for peripheral nerve blockade: a systematic review and meta-analysis. *Can J Anesth.* 2018;65(2):194–206. https://doi.org/10.1007/s12630-017-1008-8.

Cite this article: Sottie DAY, Darkwa EO, Aryee G, Essuman R, Obeng Adjei GI, Djagbletey R. Analgesic effect of perineural dexamethasone on transversus abdominis plane block: A randomised controlled trial at a tertiary hospital in Ghana. *Indian J Clin Anaesth*. 2025;12(4):700–709.