INTRAPERITONEAL INSTILLATION VERSUS WOUND INFILTRATION FOR POSTOPERATIVE PAIN RELIEF AFTER CAESAREAN SECTION

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Abstract
Background: Severe acute pain following caesarean section is a risk factor for chronic pain and postpartum depression necessitating opioids for analgesia. Objective: To compare the intraperitoneal instillation and local wound infiltration of anaesthetic agent for analgesia after caesarean section under spinal anaesthesia. Methods: This prospective, randomized, double-blind, placebo-controlled trail was conducted in the Department of Obstetrics and Gynaecology, Rajarajeswari Medical College and Hospital, Bangalore among women undergoing elective caesarean section via Pfannenstiel incision under spinal anaesthesia. The minimum estimated sample size was 23 participants in each group – Group 1, local anaesthetic wound infiltration group (LWI); Group 2, intraperitoneal local anaesthetic (IPLA) instillation group; and Group 3, placebo group. Results: The present study included a total of 69 participants – 23 in each group. The baseline characteristics of the participants (age (in years), weight (in kg), height (in metres), body mass index (in kg/m2), gestational age (in weeks), and duration of operation (in minutes)) did not vary significantly between the study group ($p>0.05$) – reducing the potential for confounding variables, which can distort study results. The mean (SD) visual analogue scale (VAS) scores assessed at rest did not vary significantly ($p>0.05$) between the study groups (1, 2 and 3) at 2 hours (10.9 (8.6) vs 12.6 (9.3) vs 13.1 (10.2)), 12 hours (20.3 (11.2) vs 22.8 (10.4) vs 24.3 (12.8)), and 24 hours (27.5 (13.2) vs 29.4 (14.6) vs 30.2 (15.7)); however, the scores progressively increased in all the groups. The mean (SD) VAS scores at movement was significantly lower in group 1 (LWI; 11.2 (7.3)) in comparison with group 2 (IPLA; 14.7 (12.3)) and group 3 (placebo; 17.2 (8.6)) ($p<0.05$) at 2 hours. However, the mean (SD) scores did not vary significantly at movement between the study group at 12 and 24 hours. Conclusion: The use of local wound infiltration of anaesthetic agent reduces early pain scores on movement in women undergoing caesarean section under spinal anaesthesia.
Keywords: Postoperative analgesia, Caesarean section, Intraperitoneal instillation, Wound infiltration, Randomized controlled trail

Introduction

Caesarean deliveries are widely performed surgical procedures globally and often result in significant postoperative discomfort.(1) Effective pain management following caesarean section is a critical concern for anaesthesiologists because inadequate pain control not only affects patient well-being but also impedes early movement, bonding between mother and baby, and overall satisfaction with the birth experience. Additionally, the use of opioids to manage pain after caesarean section, both during hospitalization and after discharge, presents risks of sedation, respiratory problems, and potential addiction.(2, 3)

Achieving optimal postoperative pain relief following caesarean section is crucial not only for immediate recovery but also for reducing the risk of chronic pain and postpartum depression.(4, 5) Given these challenges, a multimodal approach that combines different types of pain relief methods, including systemic and localized techniques, has emerged as a recommended strategy for effectively managing post-caesarean section pain.(6) Among the various regional pain relief methods, both intraperitoneal local anaesthetic (IPLA) instillation and local anaesthetic wound infiltration (LWI) have gained attention as potential ways to alleviate postoperative pain after caesarean section. Although IPLA has been studied less extensively in this specific context, it has shown effectiveness in other types of gynaecological and abdominal surgeries.(7-9) LWI, on the other hand, has demonstrated promise in reducing pain levels and the need for opioid medications after caesarean section, especially when used without long-acting intrathecal opioids.(10)

However, despite the potential advantages of these techniques, there is a significant gap in the existing literature regarding their comparative effectiveness for post-caesarean section pain relief. Against this background, the objectives of the present study were to compare the intraperitoneal instillation and local wound infiltration of anaesthetic agent for analgesia after caesarean section under spinal anaesthesia in terms of postoperative pain scores at rest (at 2, 12 and 24 hours); and at movement (at 2, 12 and 24 hours).

Materials and Methods

This prospective, randomized, double-blind, placebo-controlled trial was carried out in the Department of Obstetrics and Gynaecology at Rajarajeswari Medical College and Hospital in Bangalore, between April and May 2024. The study received approval from the Institutional Human Ethics Committee (IHEC). Participants (and their attendants) were provided with

the Participant Information Sheet (PIS) in the local language, and the contents were read aloud to them to ensure understanding. Written informed consent was obtained before enrolling participants. The study included women aged 18 to 40 years, pregnant with singletons, classified as American Society of Anaesthesiologists physical status (ASA) II, at least 34 weeks gestation, and scheduled for elective caesarean section via Pfannenstiel incision under spinal anaesthesia. Women with contraindications to neuraxial anaesthesia, allergies to any study drugs, a body mass index over 35 kg/m2, ASA scores above 3, cardiovascular diseases (CVDs), diabetes, preeclampsia, chronic pain, conversion to general anaesthesia, or drug addiction were excluded from the study.

Cetin et al. (2023)(11) conducted a research study to compare local anaesthetic wound infiltration with intraperitoneal instillation of local anaesthetic for analgesia after caesarean section under spinal anaesthesia. It was found that the mean (SD) pain scores assessed using visual analogue scale were 12.8 (18.1) in the local anaesthetic wound infiltration group, 9.8 (13.8) in the intraperitoneal local anaesthetic (IPLA) instillation group and 14.8 (18.2) in the placebo group at two hours.(11) Using this information, considering a power of 80% (or beta error of 20%) and a level of significance of 5% (two sided), for detecting a true difference in means between the test and the reference group of -5, the minimum estimated sample size was 23 participants in each group with 95% confidence – resulting in a total sample of 69. We used nonprobability sampling – convenience sampling technique to recruit the study participants in accordance with prespecified inclusion and exclusion criteria. However, to allot patients randomly into Group 1, local anaesthetic wound infiltration group (LWI); Group 2, intraperitoneal local anaesthetic (IPLA) instillation group; and Group 3, placebo group, simple randomization was done – computer generated random numbers (with the help of an independent statistician, not aware of the research hypothesis) were used.

A specially designed, semi-structured, pretested questionnaire was utilized to collect data on sociodemographic characteristics, clinical history (including gestational age), anthropometric measurements (such as height and weight), intraoperative findings (such as the duration of the operation), and visual analogue scale (VAS) scores at rest and during movement at 2 hours, 12 hours, and 24 hours. The collected data was manually entered into Microsoft Excel and analysed using the Statistical Package for Social Sciences (SPSS) version 23. Continuous variables were summarized using the mean and standard deviation, following tests for data normality using the Kolmogorov–Smirnov and Shapiro–Wilk tests. Appropriate graphs were created for visualization. To determine statistical significance, the independent t-test was applied to compare the study groups, based on the normality assumption. A p-value of less than 0.05 was considered statistically significant.

Results

The present study included a total of 69 women – 23 in Group 1, local anaesthetic wound infiltration group (LWI); 23 in Group 2, intraperitoneal local anaesthetic (IPLA) instillation group; and 23 in Group 3, placebo group (Figure 1). The baseline characteristics of the participants are shown in Table 1. The results showed that the Groups 1, 2 and 3 did not vary significantly (p>0.05) by age (in years; 30.1 (4.3) vs 30.2 (3.9) vs 30.1 (3.7)), weight (in kg; 77.2 (6.2) vs 76.9 (8.1) vs 77.5 (7.3)), height (in metres; 1.61 (0.1) vs 1.61 (0.2) vs 1.6 (0.1)), body mass index (in kg/m2; 28.9 (2.6) vs 29.1 (3.5) vs 29.2 (4.1)), gestational age (in weeks; 37.5 (1.3) vs 38.1 (1.9) vs 38.2 (1.4)), and duration of operation (in minutes; 46 (9.2) vs 48 (8.3) vs 49 (9.1)), thereby reducing the potential for confounding variables, which can distort study results.

Table 1: Baseline characteristics of the study groups

	Group 1	Group 2	Group 3	p value
	Mean (SD) N = 23	Mean (SD) N = 23	Mean (SD) N = 23	
Age (in years)	30.1 (4.3)	30.2 (3.9)	30.1 (3.7)	0.271
Weight (in kg)	77.2 (6.2)	76.9 (8.1)	77.5 (7.3)	0.572
Height (in m)	1.61 (0.1)	1.61 (0.2)	1.6 (0.1)	0.430
BMI (kg/m2)	28.9 (2.6)	29.1 (3.5)	29.2 (4.1)	0.653
Gestational age (in weeks)	37.5 (1.3)	38.1 (1.9)	38.2 (1.4)	0.925
Duration of operation (in minutes)	46 (9.2)	48 (8.3)	49 (9.1)	0.121
*Statistically significant at p<0.05 BMI, body mass index				

The mean (SD) visual analogue scale (VAS) scores assessed at rest did not vary significantly (p>0.05) between the study groups (1, 2 and 3) at 2 hours (10.9 (8.6) vs 12.6 (9.3) vs 13.1 (10.2)), 12 hours (20.3 (11.2) vs 22.8 (10.4) vs 24.3 (12.8)), and 24 hours (27.5 (13.2) vs 29.4 (14.6) vs 30.2 (15.7)); however, the scores progressively increased in all the groups (Table 2; Figure 2). The mean (SD) VAS scores at movement was significantly lower in group 1 (LWI; 11.2 (7.3)) in comparison with group 2 (IPLA; 14.7 (12.3)) and group 3 (placebo; 17.2 (8.6)) (p<0.05) at 2 hours. However, the mean (SD) scores did not vary significantly at movement between the study group at 12 (27.2 (14.6) vs 32.4 (17.1) vs 32.9 (19.3)) and 24 hours (34.1 (16.2) vs 35.8 (19.5) vs 37.7 (18.2)) (Table 3; Figure 3).

Table 2: Visual analogue scale scores at rest – at 2, 12 and 24 hours

Rest	Group 1	Group 2	Group 3	p value
	Mean (SD) N = 23	Mean (SD) N = 23	Mean (SD) N = 23	
At 2 hours	10.9 (8.6)	12.6 (9.3)	13.1 (10.2)	0.293
At 12 hours	20.3 (11.2)	22.8 (10.4)	24.3 (12.8)	0.364

At 24 hours	27.5 (13.2)	29.4 (14.6)	30.2 (15.7)	0.638
*Statistically significant at p<0.05				

Table 3: Visual analogue scale scores at movement – at 2, 12 and 24 hours

Movement	Group 1	Group 2	Group 3	p value
	Mean (SD) N = 23	Mean (SD) N = 23	Mean (SD) N = 23	
At 2 hours	11.2 (7.3)	14.7 (12.3)	17.2 (8.6)	0.036*
At 12 hours	27.2 (14.6)	32.4 (17.1)	32.9 (19.3)	0.483
At 24 hours	34.1 (16.2)	35.8 (19.5)	37.7 (18.2)	0.749
*Statistically significant at p<0.05				

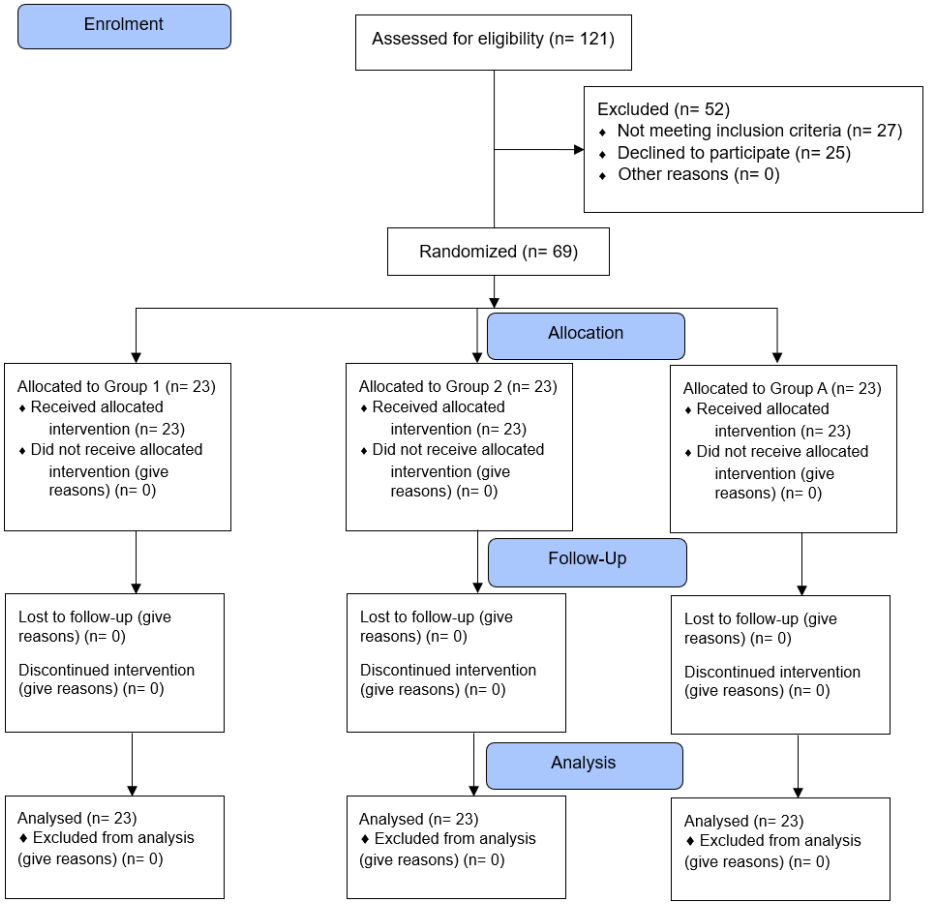

Figure 1: CONSORT flow diagram

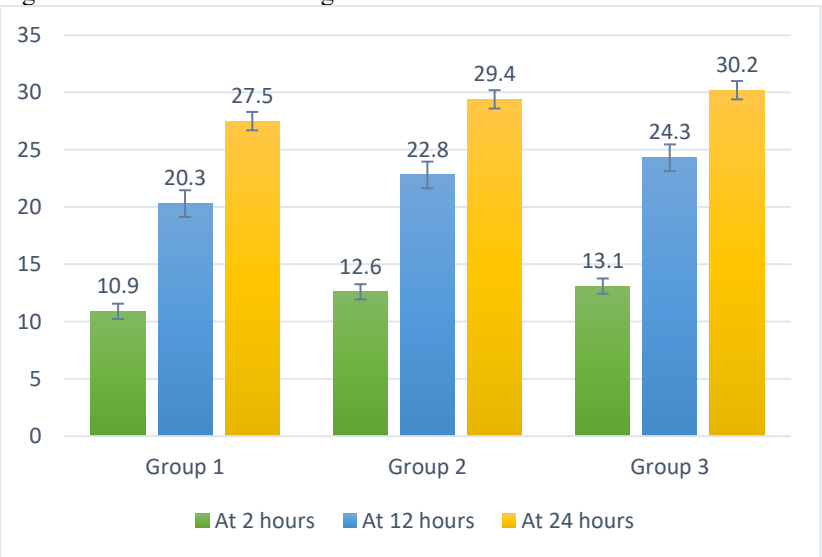

Figure 2: Visual analogue scale scores at rest – at 2, 12 and 24 hours

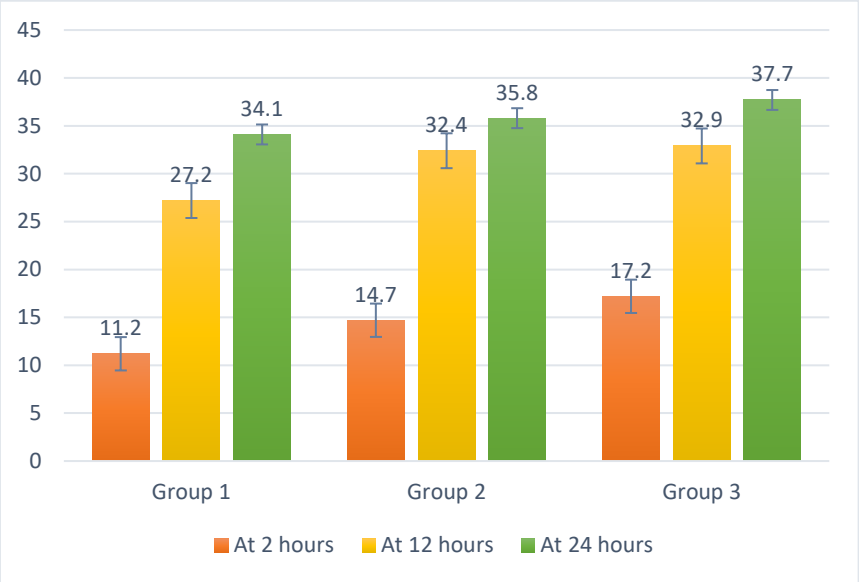

Figure 3: Visual analogue scale scores at movement – at 2, 12 and 24 hours

Discussion

The present study aimed to compare the efficacy of local anaesthetic wound infiltration, intraperitoneal local anaesthetic instillation, and placebo in providing analgesia after caesarean section under spinal anaesthesia. The baseline characteristics of the participants across the three groups were well-matched, indicating successful randomization and reducing the potential for confounding variables to influence the study outcomes. Firstly, the similarity in age, weight, height, body mass index (BMI), gestational age, and duration of operation among the three groups suggests that demographic and clinical factors were evenly distributed across the study population. This is crucial as it minimizes the risk of bias and enhances the internal validity of the study. The absence of significant differences in baseline characteristics implies that any observed variations in postoperative pain scores can be attributed to the intervention received rather than pre-existing differences among the study groups. This strengthens the credibility of the findings and increases confidence in the study's conclusions. Moreover, the use of a placebo group allows for proper blinding and controls for the placebo effect, which can significantly influence pain perception and reporting in clinical trials. By including a placebo group, the study can better elucidate the specific effects of the interventions being tested, providing valuable insights into their true efficacy.

The analysis of Visual Analogue Scale (VAS) scores assessed at rest and during movement provides insights into the effectiveness of these interventions in controlling pain at different time points post-surgery.(12) At rest, there were no significant differences in mean VAS scores between the study groups at 2, 12, and 24 hours postoperatively. However, it's noteworthy that the scores progressively increased over time in all groups, indicating a gradual escalation of pain intensity following caesarean section.(13-16) This trend is consistent with the expected postoperative course and underscores the importance of effective pain management strategies to alleviate discomfort and enhance patient comfort during the recovery period.(17) The lack of significant differences in VAS scores at rest between the intervention groups suggests that both LWI and IPLA were similarly effective in providing analgesia during periods of relative immobility. This finding aligns with previous research indicating the efficacy of both local anaesthetic techniques in reducing postoperative pain after various surgical procedures, including caesarean section.(18-20)

In contrast, differences in mean VAS scores at movement were observed among the study groups, with significantly lower scores in the LWI group compared to the IPLA and placebo groups at 2 hours postoperatively. This suggests that LWI may offer superior pain relief during early mobilization activities such as shifting positions in bed or walking, which can be particularly challenging for patients recovering from caesarean section.(21, 22) However, the differences in VAS scores at movement diminished over time, with no significant variations between the study groups at 12 and 24 hours postoperatively. This could indicate a transient advantage of LWI in mitigating movement-related pain immediately after surgery, which may diminish as the effects of the local anaesthetic wear off and the overall pain intensity increases. Overall, these findings highlight the importance of multimodal analgesia approaches in managing postoperative pain after caesarean section. While both LWI and IPLA may provide effective pain relief at rest, LWI may offer additional benefits in alleviating movement-related pain in the early postoperative period. However, further research is warranted to elucidate the optimal timing and dosage of these interventions to optimize pain management outcomes and enhance patient satisfaction following caesarean section.

The present study is not without limitations. It includes limited generalizability (being a single centre study), short term follow up (limited information about long-term outcomes or the duration of analgesic effects), and subjective outcome measurement (VAS scores relies on self-reported pain intensity, which is inherently subjective and may be influenced by individual perceptions and biases).

Conclusion

In conclusion, the present study compared the efficacy of local anaesthetic wound infiltration (LWI), intraperitoneal local anaesthetic instillation (IPLA), and placebo in providing analgesia after caesarean section under spinal anaesthesia. The findings revealed no significant differences in Visual Analogue Scale (VAS) scores at rest between the study groups at 2, 12, and 24 hours postoperatively, suggesting comparable effectiveness of LWI and IPLA in mitigating pain during periods of relative immobility. However, notable differences were observed in VAS scores at movement, with significantly lower scores in the LWI group compared to the IPLA and placebo groups at 2 hours postoperatively. This indicates a transient advantage of LWI in alleviating movement-related pain during the early postoperative period. Nevertheless, these differences diminished over time, highlighting the need for multimodal analgesia approaches to optimize pain management outcomes throughout the recovery process. Overall, the study underscores the importance of individualized pain management strategies tailored to the unique needs of patients undergoing caesarean section. While both LWI and IPLA demonstrate efficacy in controlling postoperative pain, LWI may offer additional benefits in addressing movement-related discomfort in the immediate postoperative period. These findings contribute to the growing body of evidence supporting the use of local anaesthetic techniques in enhancing patient comfort and satisfaction following caesarean section under spinal anaesthesia. Further research is warranted to refine the timing and dosage of these interventions and explore their long-term effects on postoperative outcomes.

Clinical significance

The present study holds clinical significance by directly comparing intraperitoneal local anaesthetic (IPLA) instillation and local anaesthetic wound infiltration (LWI) for postoperative pain relief after caesarean section. Understanding which technique provides superior pain relief, reduces opioid requirements, and enhances patient satisfaction can guide clinicians in optimizing pain management strategies for women undergoing caesarean delivery. By elucidating the relative merits of IPLA versus LWI, this study aims to improve postoperative outcomes, facilitate early mobilization, and enhance maternal-infant bonding, ultimately enhancing the birthing experience and promoting maternal well-being."

References

1. Bateman BT, Franklin JM, Bykov K, Avorn J, Shrank WH, Brennan TA, et al. Persistent opioid use following cesarean delivery: patterns and predictors among opioid-naïve women. Am J Obstet Gynecol. 2016;215(3):353.e1-.e18.

2. Sultan P, Patel SD, Jadin S, Carvalho B, Halpern SH. Transversus abdominis plane block compared with wound infiltration for postoperative analgesia following Cesarean delivery: a systematic review and network meta-analysis. Can J Anaesth. 2020;67(12):1710-27.

3. Dahl JB, Jeppesen IS, Jørgensen H, Wetterslev J, Møiniche S. Intraoperative and postoperative analgesic efficacy and adverse effects of intrathecal opioids in patients undergoing cesarean section with spinal anesthesia: a qualitative and quantitative systematic review of randomized controlled trials. Anesthesiology. 1999;91(6):1919-27.

4. 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.

5. Kainu JP, Sarvela J, Tiippana E, Halmesmäki E, Korttila KT. Persistent pain after caesarean section and vaginal birth: a cohort study. Int J Obstet Anesth. 2010;19(1):4-9.

6. Pan PH. Post cesarean delivery pain management: multimodal approach. Int J Obstet Anesth. 2006;15(3):185-8.

7. Patel R, Carvalho JC, Downey K, Kanczuk M, Bernstein P, Siddiqui N. Intraperitoneal Instillation of Lidocaine Improves Postoperative Analgesia at Cesarean Delivery: A Randomized, Double-Blind, Placebo-Controlled Trial. Anesth Analg. 2017;124(2):554-9.

8. Marks JL, Ata B, Tulandi T. Systematic review and metaanalysis of intraperitoneal instillation of local anesthetics for reduction of pain after gynecologic laparoscopy. J Minim Invasive Gynecol. 2012;19(5):545-53.

9. Gupta A, Perniola A, Axelsson K, Thörn SE, Crafoord K, Rawal N. Postoperative pain after abdominal hysterectomy: a double-blind comparison between placebo and local anesthetic infused intraperitoneally. Anesth Analg. 2004;99(4):1173-9.

10. Adesope O, Ituk U, Habib AS. Local anaesthetic wound infiltration for postcaesarean section analgesia: A systematic review and meta-analysis. Eur J Anaesthesiol. 2016;33(10):731-42.

11. Dagasan Cetin G, Dostbil A, Aksoy M, Kasali K, Ince R, Kahramanlar AA, et al. Intraperitoneal instillation versus wound infiltration for postoperative pain relief after cesarean delivery: A prospective, randomized, double-blind, placebo-controlled trial. J Obstet Gynaecol Res. 2023;49(1):209-19.

12. Azanu WK, Osarfo J, Larsen-Reindorf RE, Agbeno EK, Dassah E, Amanfo AO, et al. Assessment and determinants of acute post-caesarean section pain in a tertiary facility in Ghana. PLoS One. 2022;17(5):e0268947.

13. Sangkum L, Thamjamrassri T, Arnuntasupakul V, Chalacheewa T. The Current Consideration, Approach, and Management in Postcesarean Delivery Pain Control: A Narrative Review. Anesthesiol Res Pract. 2021;2021:2156918.

14. Kintu A, Abdulla S, Lubikire A, Nabukenya MT, Igaga E, Bulamba F, et al. Postoperative pain after cesarean section: assessment and management in a tertiary hospital in a low-income country. BMC Health Serv Res. 2019;19(1):68.

15. Buhagiar L, Cassar OA, Brincat MP, Buttigieg GG, Inglott AS, Adami MZ, et al. Predictors of post-caesarean section pain and analgesic consumption. J Anaesthesiol Clin Pharmacol. 2011;27(2):185-91.

16. Yurashevich M, Pedro C, Fuller M, Habib AS. Intra-operative ketorolac 15 mg versus 30 mg for analgesia following cesarean delivery: a retrospective study. Int J Obstet Anesth. 2020;44:116-21.

17. Zimpel SA, Torloni MR, Porfírio GJ, Flumignan RL, da Silva EM. Complementary and alternative therapies for post-caesarean pain. Cochrane Database Syst Rev. 2020;9(9):Cd011216.

18. Wang J, Zhao G, Song G, Liu J. The Efficacy and Safety of Local Anesthetic Techniques for Postoperative Analgesia

After Cesarean Section: A Bayesian Network Meta-Analysis of Randomized Controlled Trials. J Pain Res. 2021;14:1559-72.

19. Li X, Zhou M, Shi X, Yang H, Li Y, Li J, et al. Local anaesthetic wound infiltration used for caesarean section pain relief: a meta-analysis. Int J Clin Exp Med. 2015;8(6):10213-24.

20. Kerai S, Saxena KN, Taneja B. Post-caesarean analgesia: What is new? Indian J Anaesth. 2017;61(3):200-14.

21. Stamenkovic DM, Bezmarevic M, Bojic S, Unic-Stojanovic D, Stojkovic D, Slavkovic DZ, et al. Updates on Wound Infiltration Use for Postoperative Pain Management: A Narrative Review. J Clin Med. 2021;10(20).

22. Bamigboye A, Hofmeyr J. Local anaesthetic wound infiltration and abdominal nerves block during caesarean section for postoperative pain relief. Cochrane database of systematic reviews (Online). 2009:CD006954.