



EFFICACY OF SUBCUTANEOUS ROPIVACAINE WOUND INFILTRATION FOR POSTOPERATIVE ANALGESIA AFTER CAESAREAN SECTION: A RETROSPECTIVE OBSERVATIONAL STUDY

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Abstract

Background: Postoperative pain management following Caesarean section is crucial to facilitate early ambulation, maternal-infant bonding, and breastfeeding. Local wound infiltration with ropivacaine is a simple and cost-effective technique with minimal systemic side effects. This study aimed to evaluate the efficacy of subcutaneous ropivacaine wound infiltration in reducing postoperative pain and analgesic requirements following Caesarean section.

Methods: This retrospective observational study included 200 ASA II parturients undergoing elective Caesarean section under spinal anaesthesia at Sher-i-Kashmir Institute of Medical Sciences. Patients were divided into two groups: Group A (n=100) received 30 ml of 0.75% ropivacaine infiltration at the Pfannenstiel incision site before skin closure, and Group B (n=100) received no infiltration. Postoperative pain was assessed using a Visual Analogue Scale (VAS) at regular intervals for 24 hours. Rescue analgesia (IV paracetamol) requirements, time to first analgesia, and adverse effects were recorded.

Results: Demographic variables were comparable between groups. Group A had significantly lower VAS scores compared to Group B at most time points ($p < 0.05$). The mean time to first rescue analgesia was longer in Group A (3.9 ± 1.02 h) than in Group B (2.3 ± 0.93 h, $p < 0.001$). Total paracetamol consumption was significantly lower in Group A (1880 ± 670.8 mg) compared to Group B (2610 ± 566.6 mg, $p < 0.001$). Adverse effects were minimal and comparable.

Conclusion: Subcutaneous wound infiltration with ropivacaine significantly reduces postoperative pain intensity and analgesic requirements following Caesarean section, prolonging the time to first rescue analgesia without increasing adverse effects. This simple, cost-effective technique enhances postoperative recovery and maternal comfort.

Introduction

Pain is defined as an unpleasant sensory and emotional experience associated with actual or potential tissue damage [1]. Postoperative pain following Caesarean section is a complex, multifaceted phenomenon with nociceptive, inflammatory, visceral, and neuropathic components [2]. The International Association for the Study of Pain emphasizes that pain not only serves as a warning signal but also triggers neuroendocrine and immune responses that can affect multiple organ systems [3]. Inadequately managed pain is associated with complications such as delayed

ambulation, thromboembolic events, respiratory compromise, and progression to chronic pain syndromes [4,5].

The incidence of moderate to severe pain after Caesarean section remains as high as 70% despite advances in anaesthesia and analgesia [6]. Effective postoperative analgesia is essential not only for maternal comfort but also for early mobilization, establishment of breastfeeding, and formation of the maternal-infant bond [7]. It also reduces postoperative morbidity, shortens hospital stay, and enhances patient satisfaction [8].

Several modalities exist for postoperative pain control after Caesarean section. Systemic opioids remain widely used but are associated with sedation, respiratory depression, nausea, vomiting, urinary retention, and transfer to breast milk, which can affect the newborn [9,10]. Non-steroidal anti-inflammatory drugs (NSAIDs) are effective against visceral pain but may be contraindicated in patients with hypertensive disorders of pregnancy or renal dysfunction [11]. Regional anaesthetic techniques, including transversus abdominis plane (TAP) block and neuraxial opioids, provide effective analgesia but require expertise and carry risks such as local anaesthetic toxicity, motor blockade, and delayed ambulation [12,13].

Local wound infiltration with long-acting local anaesthetics has emerged as a simple, safe, and cost-effective component of multimodal analgesia [14]. It involves injecting a local anaesthetic directly into the surgical incision site before skin closure. This technique targets the nociceptive input at its origin, thereby reducing central sensitization and subsequent pain amplification [15]. Ropivacaine, a long-acting amide-type local anaesthetic, offers significant advantages over bupivacaine due to its lower lipophilicity, reduced motor blockade, and lower cardiotoxicity [16]. Its preferential blockade of A-delta and C fibers, responsible for transmitting pain signals, without significant impact on motor function, makes it particularly advantageous in obstetric patients [17].

The mechanism of action of ropivacaine involves reversible inhibition of sodium ion influx through voltage-gated sodium channels, preventing the initiation and propagation of action potentials along nerve fibers [18]. This blocks pain transmission from the surgical site to the central nervous system. Additionally, ropivacaine has been shown to inhibit potassium channels and modulate inflammatory mediators, potentially contributing to its analgesic properties [19]. Its high protein binding (~94%) and hepatic metabolism via CYP1A2 and CYP3A4 ensure sustained duration of action and predictable pharmacokinetics [20].

Previous studies have demonstrated the efficacy of local wound infiltration in various surgical settings. Møiniche et al. [1] reported improved postoperative pain control following incisional infiltration in abdominal surgeries. Patrick et al. [2] found that ropivacaine infiltration reduced pain scores and delayed analgesic requirements following inguinal hernia repair. Bamigboye et al. [6] highlighted its opioid-sparing effects after Caesarean delivery. Moreover, Ester et al. [3] demonstrated improved recovery and reduced hospital stay with continuous ropivacaine wound infusion after nephrectomy.

Despite robust evidence supporting local anaesthetic infiltration, variations in technique, dosing, and study design have led to inconsistent findings [21]. Further evidence from well-designed studies is necessary to support its routine use in obstetric practice. This study was conducted to evaluate the efficacy of subcutaneous ropivacaine wound infiltration in reducing postoperative pain and analgesic requirements following elective Caesarean section.

Aims and Objectives

Primary Outcomes:

- To assess acute postoperative pain using Visual Analogue Scale (VAS) scores for the first 24 hours [22].

- To compare rescue analgesic (paracetamol) consumption between the two groups in the first 24 hours.

Secondary Outcomes:

- To observe the occurrence of adverse effects such as postoperative nausea, vomiting, and pruritus.

Results

Table 1 – Mean Age of Study Patients

Group	N	Mean Age (years)	SD	Range	P-value
A	100	29.0	3.345	23–35	0.691
B	100	28.8	3.385	23–34	

Stats: No statistically significant difference in mean age between groups ($p=0.691$).

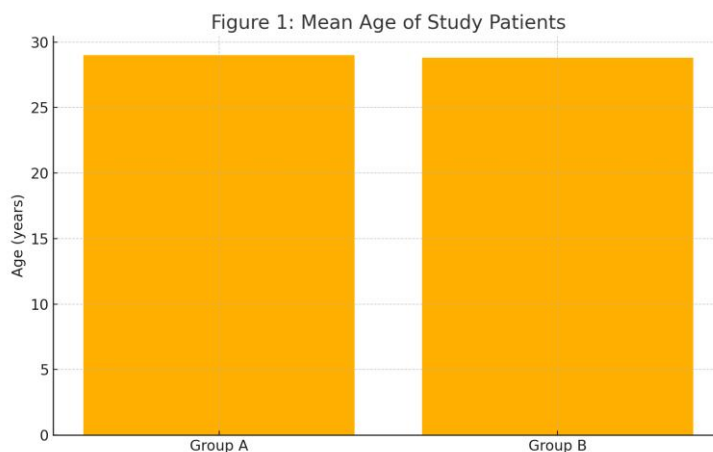


Figure 1: Mean age distribution between Group A and Group B.

Table 2 – Mean Weight of Study Patients

Group	N	Mean Weight (kg)	SD	Range	P-value
A	100	76.9	5.032	65–86	0.103
B	100	78.1	5.074	68–87	

Stats: No significant difference in mean weight between groups ($p=0.103$).

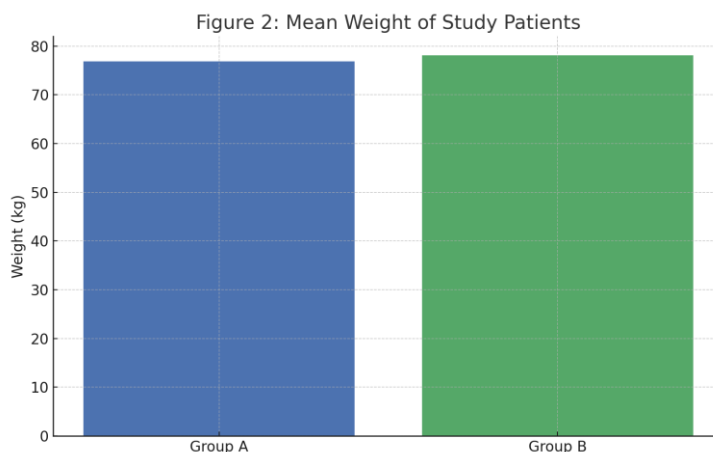


Figure 2: Comparison of mean weight between Group A and Group B.

Table 3 – Sensory Block Distribution

Level	Group A (%)	Group B (%)
T4	41	35
T5	35	34
T6	24	31

Stats: Distribution of sensory block levels was not statistically significant ($p=0.502$).

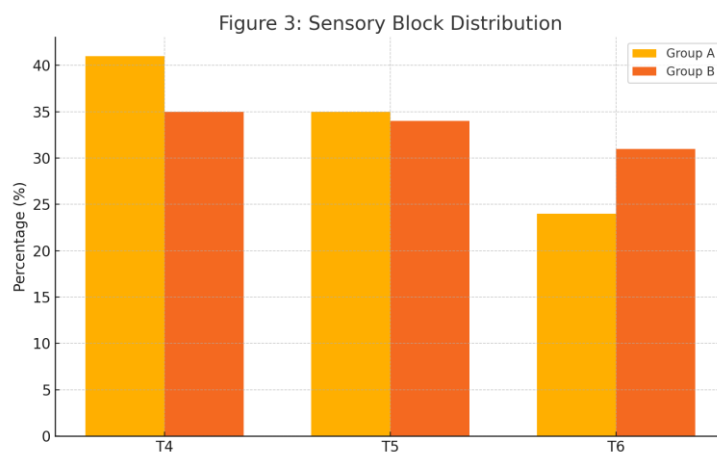


Figure 3: Comparison of sensory block distribution between groups.

Table 4 – Duration of Surgery

Group	N	Mean Duration (min)	SD	Range	P-value
A	100	51.9	8.694	40–65	0.685
B	100	52.4	8.717	40–70	

Stats: Mean duration of surgery was comparable ($p=0.685$).

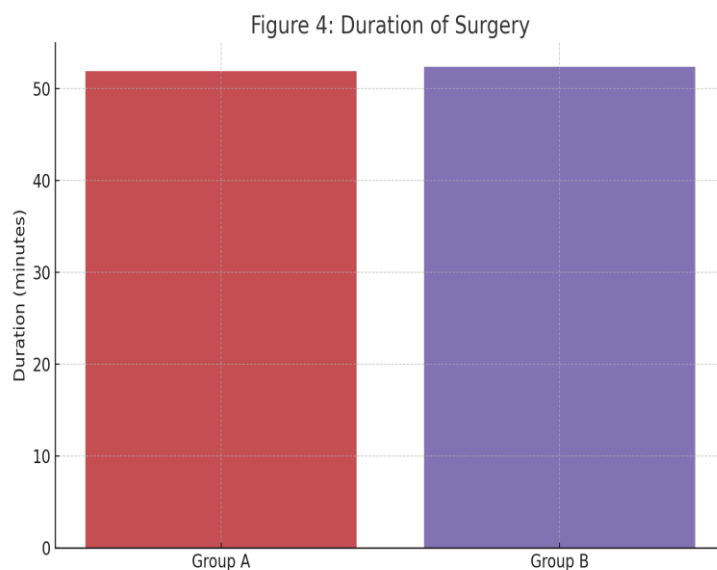


Figure 4: Mean duration of surgery comparison between groups.

Table 5 – Time to First Rescue Analgesia

Group	N	Mean Time (hours)	SD	Range	P-value
A	100	3.9	1.023	2–6	<0.001*
B	100	2.3	0.931	0–4	

Stats: Significantly longer time to first rescue analgesia in Group A ($p<0.001$).

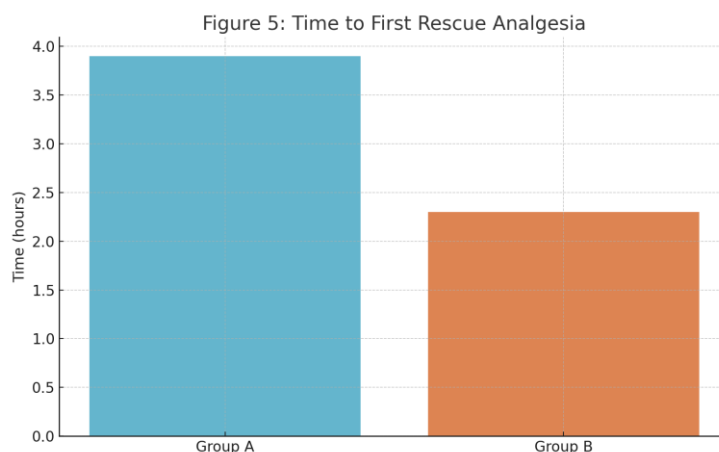


Figure 5: Comparison of mean time to first rescue analgesia between groups.



Table 6 – Total Paracetamol Consumption

Group	N	Mean PCM Consumption (mg)	SD	Range	P-value
A	100	1880	670.896	1000–3000	<0.001*
B	100	2610	566.667	2000–4000	

Stats: Total paracetamol consumption was significantly lower in Group A ($p < 0.001$).

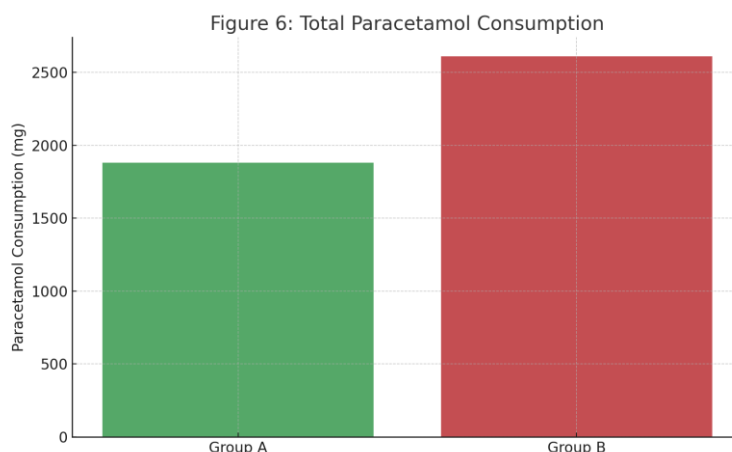


Figure 6: Total paracetamol consumption in 24 hours between groups.

Discussion

Effective postoperative analgesia after Caesarean section is critical for early ambulation, initiation of breastfeeding, and maternal-infant bonding [1,4]. In our study, subcutaneous ropivacaine infiltration significantly reduced postoperative pain scores, prolonged the time to first rescue analgesia, and lowered total analgesic consumption compared to the control group. These findings support the growing body of evidence favoring local anaesthetic wound infiltration as part of multimodal analgesia.

Our findings are consistent with those of **Fahima et al.** [11], who demonstrated reduced pain scores and analgesic requirements with ropivacaine infiltration following Caesarean section. Kunpeng et al. [13] reported similar outcomes after cervical laminoplasty, highlighting the broad applicability of this technique. **Anju Gautam et al.** [10] observed a significant prolongation of analgesia duration with ropivacaine infiltration in obstetric patients. Moreover, Bamigboye et al. [6] demonstrated reduced opioid consumption and lower pain scores with wound infiltration in Caesarean deliveries.

Patrick et al. [2] observed reduced pain scores and delayed analgesic requirements with ropivacaine infiltration in inguinal hernia repair, while **Ester et al.** [3] reported improved recovery profiles and shorter hospital stays with continuous wound infusion. **Ka Wai Tam et al.** [8] conducted a meta-analysis demonstrating reduced pain severity in patients receiving wound infiltration after breast surgery.

Some studies, however, have reported inconsistent results. **Kunpeng Li et al.** [14] found no significant difference in VAS scores following ropivacaine infiltration in lumbar fusion surgery. Such discrepancies could be attributed to differences in surgical technique, analgesic regimens, infiltration depth, and sample size. These findings underscore the need for standardized protocols and further randomized controlled trials. The clinical implications of our findings are significant. Subcutaneous ropivacaine infiltration is a simple, safe, and cost-effective technique that can be easily integrated into existing perioperative protocols. It does not require specialized training or equipment and can be performed by the operating surgeon. Importantly, its safety profile, characterized by minimal systemic absorption and low risk of toxicity, makes it especially suitable for postpartum patients [17].

Future research should focus on optimizing dosing strategies, evaluating continuous infiltration techniques, and assessing long-term outcomes such as chronic pain prevention. The potential synergistic effects of combining local infiltration with other regional techniques like TAP block or neuraxial opioids also warrant investigation [24].

Overall, our study adds to the growing evidence base supporting the use of local anaesthetic wound infiltration in Caesarean section. It offers a safe, effective, and practical approach to improving postoperative pain control and patient outcomes.

Conclusion

Subcutaneous wound infiltration with ropivacaine significantly reduces postoperative pain and analgesic requirements, prolongs the time to first rescue analgesia, and enhances postoperative recovery following Caesarean section. This simple, cost-effective, and safe technique should be considered as part of multimodal postoperative analgesia strategies in obstetric anaesthesia [25].

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