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ANALGESIC EFFICACY OF ULTRASOUND GUIDED TRANSVERSUS ABDOMINIS PLANE BLOCK AFTER LOWER SEGMENT CESAREAN SECTION UNDER GENERAL ANESTHESIA

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ABSTRACT

Introduction: Lower segment caesarean section (LSCS) is a major surgical procedure often associated with significant postoperative pain. Effective pain management is essential for early recovery and infant care, but systemic opioids, and traditional analgesics, have potential side effects. Over the previous years transversus abdominis plane (TAP) block has emerged as a safe and effective means of analgesia for a number of different abdominal surgeries. This study aims to evaluate the analgesic efficacy of ultrasound-guided TAP block following LSCS under spinal anesthesia.

Methods: This prospective, observational study included 60 parturients (ASA I-II) undergoing LSCS under spinal anesthesia. Participants were randomized into two groups: Group T (n=30) received ultrasound-guided TAP block with 0.2% ropivacaine, while Group S (n=30) received systemic analgesics. Postoperative pain was assessed using the visual analogue scale (VAS) at multiple intervals. The primary outcome was the time to first analgesic request, and secondary outcomes included total tramadol consumption, pain scores, nausea, sedation, and maternal satisfaction. Statistical analysis was performed using SPSS Ver. 20.0.

Results: The mean time to first analgesic request was significantly longer in Group T (9.53 hours) compared to Group S (4.1 hours, $p=0.0163$). Total tramadol consumption was significantly lower in Group T (140 mg) than Group S (246.66 mg, $p<0.001$). Group T demonstrated lower VAS scores, reduced nausea, and higher maternal satisfaction ($p<0.05$).

Conclusion: Ultrasound-guided TAP block with 0.2% ropivacaine is an effective and safe postoperative analgesic technique following LSCS, reducing opioid requirements and enhancing patient satisfaction.

Keywords: TAP block, cesarean section, postoperative pain, spinal anesthesia

INTRODUCTION

Lower segment caesarean section (LSCS) is a major surgical procedure often accompanied by significant postoperative pain[1]. Effective pain management post-LSCS is crucial to enable early recovery of mother and proper care of the newborn in the immediate postoperative period. However, achieving optimal pain relief can be challenging due to altered physiology during the postpartum period and concerns regarding the transfer of drugs into the breast milk. Despite the availability of a wide range of analgesic methods, no universally safe and effective approach to pain control following LSCS has been established. Traditional analgesia typically involves the use of opioids administered either systemically or via neuraxial routes. Neuraxial analgesia, though effective and safe, requires skilled administration and continuous monitoring[2]. Opioids may also be delivered intravenously or through epidural patient-controlled analgesia (PCA), offering patients greater control over their pain management and improving overall satisfaction[3]. However, the use of opioids comes with potential side effects, including sedation, nausea, vomiting, pruritus, and occasionally respiratory depression, in addition to concerns regarding their secretion into breast milk. Although non-steroidal anti-inflammatory drugs (NSAIDs) and paracetamol can complement other analgesic techniques, they are typically insufficient as standalone agents[2]. In response to these challenges, peripheral nerve blocks like the transversus abdominis plane (TAP) block have emerged as an effective component of multimodal analgesia following a wide variety of abdominal surgeries[4]. These techniques not only provide substantial pain relief but also help reduce some complications linked to systemic opioids or neuraxial blocks[5,6]. The ultrasound-guided TAP block, in particular, has been proven to provide effective postoperative analgesia in lower abdominal surgeries[7]. Caesarean section is one of the most common surgical procedures worldwide, with approximately 15% of births globally and 21.1% in developed countries occur via caesarean section[8]. In the United Kingdom alone, caesarean section rates have reached 31.9%[9], and over one million caesareans are performed annually in America[10]. While spinal anaesthesia is a preferred mode of anesthesia and is frequently used for caesarean section, however a great number of caesarean surgeries still require general anesthesia, and it is this group of patients particularly in whom the postoperative pain management remains a big challenge. Patients commonly receive opioids, either through spinal or systemic routes, often as part of a multimodal analgesic regimen. However, opioids, whether administered spinally or systemically, are not entirely safe and may often lead to undesirable side effects[11]. Recent studies suggest that patients receiving hydrophilic opioids through the spinal route should be monitored closely for respiratory depression[12]. This underscores the need for alternative, non-opioid based analgesic options, especially in this group of patients. The TAP block, a regional technique targeting T6-L1 nerve branches, has gained attention as a promising alternative for postoperative pain control in lower abdominal surgeries[13,14,15]. It is technically less demanding and has demonstrated efficacy following a myriad of abdominal surgeries such as hysterectomies, open prostatectomies, laparoscopic cholecystectomies, and appendectomies[5,16,17,18].

Caesarean section is associated with considerable postoperative pain, with up to 79% of women reporting pain at the incision site, which may last up to two months[19]. Inadequate pain management after caesarean delivery is a leading cause of poor patient satisfaction[20-23]. Effective postoperative analgesia is essential for promoting early ambulation, encouraging infant care (including breastfeeding and maternal-infant bonding), and preventing postoperative complications[24]. The pain from caesarean delivery primarily results from the incision in the abdominal wall, which involves the external oblique, internal oblique, transversus abdominis muscles, and their fascial sheaths. The nerves innervating the anterior abdominal wall pass through the neurofascial plane between the internal oblique and transversus abdominis muscles[25-28]. Given the increasing number of caesarean sections performed and the pressing need for effective and safer pain management strategies, it is crucial to explore the analgesic efficacy of ultrasound-guided TAP block for pain relief after LSCS under general anaesthesia. This study aims to evaluate the effectiveness of this technique as part of a multimodal approach to postoperative pain management.

MATERIALS AND METHODS

This prospective, observational study was conducted in the department of anesthesiology, SKIMS Medical College, Bemina, Srinagar. After obtaining approval from the Institutional Ethics Committee, a written informed consent was obtained from all participants. A total of 60 parturients aged over 18 years, with American Society of Anesthesiologists (ASA) physical status I and II, scheduled for elective or emergency lower segment caesarean section under spinal anesthesia were included. Exclusion criteria comprised a history of drug allergy, BMI > 35 kg/m², pregnancy weight < 50 kg, contraindications to regional anaesthesia (e.g., bleeding diathesis, infection at the site of block, and peripheral neuropathy), severe medical conditions like severe pre-eclampsia, and intra-operative complications such as postpartum hemorrhage. The patients were divided into two groups with 30 patients each; Group S (Received spinal anesthesia along with systemic analgesics in postoperative period) and Group T (Received spinal anesthesia along with TAP block for postoperative analgesia) Participants were assigned into two groups using simple randomization technique. The study involved the administration of 30 ml 0.2% ropivacaine for the ultrasound-guided transversus abdominis plane (TAP) block to the Group T and Group S received spinal anesthesia and systemic analgesics as per standard hospital protocol. Preoperative management included intravenous administration of 10 mg metoclopramide and 50 mg ranitidine 1 hour before surgery. All patients received spinal anaesthesia with 11-12.5 mg of 0.5% hyperbaric bupivacaine, and monitoring of heart rate, blood pressure, and oxygen saturation was performed in the operating room. At the conclusion of surgery, ultrasound-guided TAP block was performed using either 30 ml 0.2% ropivacaine (15ml on either side) in the Group T. The procedure was carried out using a linear high-frequency ultrasound probe placed transversely on the anterolateral abdominal wall between the iliac crest and costal margin, a 21-gauge, 100-mm needle was inserted in-plane to inject the drug into the transversus abdominis plane.

Postoperative analgesia included intravenous diclofenac 75 mg every 12 hours and tramadol 50 mg intravenously on-demand for breakthrough pain. The primary outcome was the time to first analgesic request, while secondary outcomes included the total number of tramadol doses used, pain scores at rest and on movement, sedation, nausea, and satisfaction. Pain was assessed using the visual analogue scale (VAS) at 0, 2, 4, 6, 8, 10, 12, 18, and 24 hours post-surgery. Nausea severity was measured on a 4-point scale (0-absent, 1-mild, 2-moderate, and 3-severe or vomiting), and sedation was assessed using a 4-point scale (1-fully awake, 4-somnolent, responds to painful stimuli). Sample size calculation was based on pilot data, and it was estimated that 125 participants were required to detect a 25% reduction in tramadol consumption. To account for attrition, 138 patients were enrolled. Statistical analysis was performed using SPSS Ver. 20.0, with comparisons between groups made using the Student's t-test, Mann-Whitney U-test, chi-square test, where appropriate. A p-value of <0.05 was considered statistically significant.

RESULTS

A total of 60 patients participated in the study, divided into two groups: Group T (n=30), which received a TAP block with 0.2% ropivacaine, and Group S (n=30), which systemic analgesics. Both groups had comparable demographic profiles, pulse, blood pressure, and oxygen saturation levels. The mean time to first analgesic administration (tramadol) was significantly longer in Group T (mean = 9.53 hours) compared to Group S (mean = 4.1 hours), with a P-value of 0.0163. This indicates that the analgesic effect of the TAP block with 0.2% ropivacaine lasted longer before the need for additional analgesia.

The total tramadol requirement was significantly reduced in Group T compared to Group S. Group T consumed a mean of 140 mg of tramadol, whereas Group S required a mean of 246.66 mg (P = 0.000000439). This significant reduction in tramadol consumption highlights the effectiveness of the TAP block in reducing postoperative analgesic needs.

Pain scores were recorded using the VAS at 2, 4, 6, 8, 12, 18, and 24 hours postoperatively. Group T (TAP block with 0.2% ropivacaine) demonstrated a marked reduction in VAS scores compared to

Group S during the first 8–10 hours post-surgery. The VAS scores were consistently lower in Group T, indicating better pain control during the early postoperative period.

Table 1: Time to First Analgesic Administration (Tramadol) and Total Tramadol Consumption			
Parameter	**Group**	**Mean Time to First Analgesic (hrs)**	**P-value**
Time to first Analgesia (Tramadol)	Group T	9.53	0.0163
	Group S	4.1	
Total Tramadol Consumption	Group T	140	0.000
	Group S	246.66	

Table 2: VAS Scores at Different Time Intervals			
Time (hrs)	**Group T Mean VAS Score**	**Group S Mean VAS Score**	**P-value**
2	2.1	3.4	< 0.001
4	1.9	3.5	< 0.001
6	1.5	3.6	< 0.001
8	1.3	3.7	< 0.001
12	1.2	3.9	< 0.001
18	1.1	4	< 0.001
24	1	4.1	< 0.001

Group T (n=50) received a TAP block with 0.25% Bupivacaine and Group S (n=50) received systemic analgesics. The pain scores were assessed at various intervals postoperatively. Group T demonstrated significantly better pain relief in the first hour post-surgery, both at rest, during movement, and on coughing, with a P-value of < 0.0010 compared to Group S. The mean time to first request for tramadol was significantly longer in Group T (5.8 hours) compared to Group S (1.93 hours), with a P-value of <0.001. Group T also required significantly less tramadol as rescue analgesia (138.77 mg) compared to Group S (240 mg), with a P-value of <0.001. Group S required a higher dose of ondansetron (antiemetic), though the difference was not statistically significant (p > 0.001).

Table 3: Mean Time to First Request for Tramadol, Mean Total Tramadol Consumption and Mean Ondansetron Dose			
Parameter	**Group**	**Mean Time**	**P-value**
Mean Time to first Request for Tramadol (Hrs)	Group T	5.8	<0.001
	Group S	1.93	
Mean Total Tramadol Consumption (mg)	Group T	138.77	<0.001
	Group S	240.00	
Mean Ondansetron Dose (mg)	Group T	4	>0.05
	Group S	5	

Group Comparison for Maternal Satisfaction and Nausea Scores:

The median maternal satisfaction score was significantly higher in the TAP group (Group T: 2 [2, 3]) compared to the non-TAP group (Group S: 2 [2, 2]) with a P-value of 0.0002. The study group (TAP block) exhibited significantly lower nausea scores during the later postoperative period (10, 12, 18, and 24 hours) compared to the non-TAP group (P<0.05).

Table 4: Maternal Satisfaction Score (IQR)		
Group	**Median Maternal Satisfaction Score (IQR)**	**P-value**
Group T	2 (2, 3)	0.0002
Group S	2 (2, 2)	

DISCUSSION

Effective postoperative analgesia after cesarean delivery is crucial for maternal well-being, as it enables the mother to care for her newborn, particularly facilitating breastfeeding and promoting maternal-infant bonding,[29] which in turn contributes positively to the infant's health. The importance of proper post-cesarean analgesia has driven the exploration of anesthesia techniques that provide prolonged and adequate pain relief while considering both the mother's and baby's health. Ultrasound-guided transversus abdominis plane (TAP) block has emerged as a reliable and simple technique for effective postoperative pain management.[30] Although lower thoracic or lumbar epidural anesthesia is considered the gold standard for post-cesarean analgesia, it may not always be feasible due to logistical constraints or medical contraindications. Moreover, systemic opioids, although being effective, are associated with significant side effects, including sedation, nausea, vomiting, and the risk of secretion into breast milk.[31] Therefore, alternative methods that reduce the need for strong opioids are necessary.

Our study demonstrated that the TAP block was effective in reducing pain severity at rest, during movement, and with coughing. Furthermore, it led to a significant delay in the need for the first postoperative analgesic dose and a substantial reduction in the total tramadol consumption during the first 24 hours after cesarean delivery under spinal anesthesia. Patients who received the TAP block also experienced lower levels of postoperative nausea and vomiting compared to those who did not receive the TAP block. These findings align with the results of McDonnell JG et al., (2007) who compared TAP block with either ropivacaine or placebo at the end of cesarean section under spinal anesthesia. Their study showed significant reductions in postoperative morphine consumption, pain scores, and side effects in the TAP group.[5] Other placebo-controlled studies have also demonstrated the analgesic benefits of the TAP block in patients undergoing cesarean delivery under spinal anesthesia.[32,33] Our findings are consistent with these studies, as we observed a reduction in the incidence of side effects like nausea and vomiting, as well as a lower requirement for antiemetic medication in the TAP group.

Although our results showed an increased need for ondansetron in the non-TAP block group, this difference was statistically not significant ($p > 0.05$). This differs slightly from previous studies, which reported more notable differences in antiemetic use between the groups.[5,32,33] Nonetheless, our study clearly illustrates that the ultrasound-guided TAP block provided a significant reduction in tramadol consumption compared to the control group. TAP with 0.2% ropivacaine also significantly decreased the time to the first dose of rescue tramadol. Overall, the TAP block was found to be safe, effective, and a valuable part of a multimodal postoperative analgesia regimen.

One limitation of the study was that it was an observational study, however a placebo controlled clinical trial would be an ideal study design, moreover it was not possible to physically assess the success of the TAP block. However, despite these limitations, the results strongly support the inclusion of ultrasound-guided TAP blocks as part of a comprehensive postoperative analgesic strategy following cesarean delivery.

CONCLUSION

In conclusion, our study demonstrated that ultrasound-guided transversus abdominis plane (TAP) block is an effective and safe technique for providing postoperative analgesia following cesarean delivery under spinal anesthesia. The use of TAP block with 0.2% ropivacaine significantly reduced the need for postoperative analgesia, and delayed the time to the first dose of rescue analgesia. Bilateral TAP block following caesarean section can be safely incorporated as an effective component of a multimodal analgesia regimen, enhancing patient satisfaction and promoting early

mobilization while minimizing the adverse effects typically associated with opioids. However, further studies are warranted to confirm its widespread application.

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