

# Impact of Multimodal Enhanced Recovery after Cesarean Delivery Protocol Including Transversus Abdominis Plane Block on Postoperative Pain and Recovery after Cesarean Deliveries: An Experience at a Tertiary Hospital in South India

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## ABSTRACT

**Aim:** The study aims to compare postoperative pain and recovery with a tailored multimodal Enhanced Recovery after Cesarean Delivery (mERCD) protocol and conventional postoperative management protocol after elective cesarean delivery.

**Materials and methods:** This prospective cohort study involved women undergoing elective cesarean delivery. One group of women received the new multimodal ERCD (mERCD) protocol, and the other group, conventional management. The mERCD group had transversus abdominis plane (TAP) block, gum chewing, early oral initiation, and urinary catheter removal. The conventional group received standard analgesia, started on orals, and had catheter removal at 24 hours.

We compared postoperative pain and recovery between the groups at 6 and 24 hours using a visual analog scale (VAS) and predefined variables assessing recovery.

**Results:** Pain scores at rest in mERCD group and the conventional group were 4.20 and 6.19 at 6 hours ( $p = 0.005$ ) and 3.71 and 4.1 at 24 hours ( $p = 0.018$ ). Respective pain scores with the movement were 4.84 and 6.35 ( $p = 0.005$ ) at 6 hours and 3.74 and 4.91 at 24 hours ( $p = 0.005$ ). Return of bowel sounds at 6 hours was 100% and 123 (82%) in mERCD and conventional groups, respectively ( $p = 0.005$ ). In mERCD group, 49 (70%) passed flatus at or before 24 hours, whereas in the conventional protocol group, the same it happened before 24 hours in 84 (56%) ( $p = 0.04$ ). There was no significant difference in the time taken to pass urine after catheter removal; the mERCD group had higher satisfaction scores 7.02 SD 1.16 than 4.05 SD 1.06 in the conventional group ( $p = 0.005$ ).

**Conclusion:** Multimodal Enhanced Recovery after Cesarean Delivery protocol effectively improved women's postoperative experience by providing good analgesia and enhancing early recovery.

**Clinical significance:** Hospitals must adopt a tailored multimodal early recovery after surgery (ERAS) approach to enhance postoperative recovery after cesarean delivery.

**Keywords:** Cesarean delivery, Multimodal protocol, Postoperative pain, Prospective cohort study, Recovery, Transversus abdominis plane block.

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## INTRODUCTION

The postoperative period after cesarean delivery requires high dependency care and monitoring; postoperative pain relief and recovery influence the overall experience as well as mother-to-newborn bonding.

The ERAS Society published separate guidelines for antenatal, intraoperative, and postoperative care for women undergoing cesarean delivery.<sup>1-3</sup> These guidelines include all probable measures in the ERAS management of the patient undergoing elective cesarean delivery. Similarly, the anesthesia component of the care is extensively addressed in the SOAP ERAC Consensus Statement by The Society for Obstetric Anesthesia and Perinatology.<sup>4</sup>

The present study involves multimodal early recovery protocol including TAP block for continuous pain relief in addition to specified measures to enhance recovery. Several studies have proven that TAP block used as a part of multimodal analgesia effectively reduces postoperative pain.<sup>5-8</sup>

The study's objective was to compare the postoperative pain relief and recovery between conventional postoperative management protocol and the mERCD protocol.

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## MATERIALS AND METHODS

This prospective interventional study was conducted in the Department of Obstetrics and Gynaecology in a tertiary hospital from

September 2015 to August 2017. The Institutional Ethical Committee approved the study (IEC number 517/2015).

For the study, the obstetricians formulated a modified version of the existing Fast-track/ERAS protocol, emphasizing postoperative pain relief in consultation with the anesthetist team. Components included in enhanced multimodal recovery after cesarean delivery protocol (mERCD) were (a) transversus abdominis plane block as postoperative analgesia; (b) chewing gum (sugar-free) three times 2-hourly starting 2 hours after surgery; (c) early oral feeding: oral fluids irrespective of bowel sounds; (d) Early urinary catheter removal: 6 hours after surgery.

Sample size was calculated for each group, based on Cohen effect size with a moderate effect size of 0.5 and 80% power was 63.

Women for elective lower segment cesarean delivery under spinal anesthesia were eligible for inclusion in the study. The exclusion criteria were: emergency cesarean deliveries, classical cesareans, those who had dense adhesions, intraoperative bowel or bladder injury or postpartum hemorrhage, those who received general anesthesia and when the duration of surgery exceeded 2 hours.

Women scheduled for elective lower segment cesarean delivery under spinal anesthesia had to decide on either mERCD protocol or the conventional protocol. Accordingly, they belonged to either of the two groups for the study—the mERCD group and the conventional protocol group.

We obtained written informed consent from the enrolled women. Women included in the study received sodium phosphate enema the night before surgery, and they were kept nil per oral for 12 hours prior to surgery. Self-retaining Foley's catheter was used to catheterize the bladder.

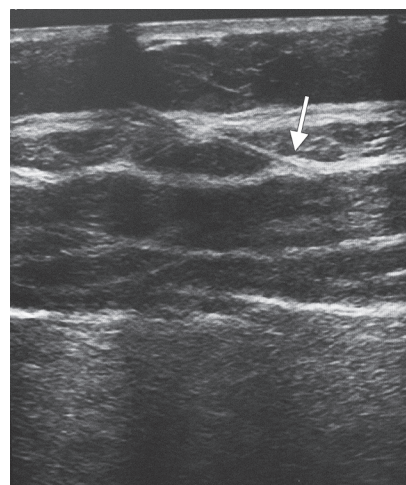
Patients in both groups received spinal anesthesia with 0.5% heavy bupivacaine using a 25 gauge needle. After the test dose, they received a prophylactic antibiotic with intravenous ceftriaxone 2 g.

After the surgery, women in mERCD group were administered TAP block under transabdominal ultrasound guidance. Women in the conventional protocol group received postoperative analgesia as per standard protocol.

The transversus abdominis plane block is a regional/peripheral nerve block that blocks abdominal wall neural afferents between T6 and L1 and thus can relieve pain associated with an abdominal incision, skin, muscles, and parietal peritoneum. It is a regional block in the transversus abdominis plane, between the internal oblique and the transversus abdominis muscles.

Transversus abdominis plane block was administered under ultrasound guidance using an ultrasound machine with a high frequency (5–12 MHz) linear array. A 100 mm stimuplex needle injected 20 mL of 0.25% Bupivacaine on each side. An ultrasound probe was placed transverse to the lateral abdominal wall along the mid-axillary line, between the lower costal margin and iliac crest. The needle was introduced parallel to the plane of the ultrasound probe directly under the probe (in-plane technique) and advanced until it reached the plane between the internal oblique and transversus abdominis muscles. On visualizing the needle in the transversus abdominis plane, 2 mL of saline was injected to confirm the correct needle position, after which 20 mL of local anesthetic solution was injected (Fig. 1). A single trained anesthetist administered the TAP block to all participants.

Components of the two protocols were as shown:



**Fig. 1:** TAP block: high-resolution ultrasound image shows in-plane insertion of the needle into transversus abdominis plane (arrow)

### mERCD

- Analgesia:
  - Ultrasound (USG)-guided “transversus abdominis plane block.”
  - Diclofenac rectal suppository 100 mg 12th hourly
- Analgesia on demand: Injection Paracetamol 1 g intravenous/ Injection Tramadol 50 mg intramuscular
- Intravenous fluids 100 mL/hour for 6 hours
- Chewing gum (sugar-free) three times 2-hourly starting 2 hours after surgery
- Starting oral fluids 6 hours after surgery
- Urinary catheter removal 6 hours after surgery

### Conventional

- Analgesia:
  - Injection Tramadol 50 mg intramuscular eighth hourly/ Injection Promethazine 25 mg intramuscular eighth hourly
  - Diclofenac suppository rectal 100 mg 12th hourly
- Analgesia on demand: Injection Paracetamol 1 g intravenous fluids 100 mL/hour for 24 hours
- Starting oral fluids 24 hours after cesarean after ensuring bowel sounds
- Urinary catheter removal after 24 hours

Postoperatively pain intensity was measured using the visual analog scale (VAS) ranging from 0 to 10. Patients' pain scores at rest and with the movement were monitored at 6 and 24 hours post surgery. Both groups received additional analgesia on demand; the number and timing of the same were noted.

Women were encouraged to pass urine after catheter removal and were assessed based on the time taken to void urine, presence of urinary retention, and need for re-catheterization. Return of bowel sounds was checked at 6 and 24 hours.

We considered the following variables to compare postoperative pain in groups receiving mERCD protocol and conventional protocol: (a) pain at rest at 6 and 24 hours; (b) pain on movement at 6 and 24 hours; (c) time of demand of first additional analgesia. Variables considered for assessing postoperative recovery were: (a)

presence of bowel sounds at 6 and 24 hours; (b) passage of flatus at 6 and 24 hours; (c) time to first voiding of urine; (d) patients' satisfaction at the end of 24 hours. A VAS was used to score the patients' satisfaction with the treatment modality.

We used Statistical Package for Social Sciences (SPSS 16 for windows) for data compilation and statistical analysis. Independent sample *t*-test was used to calculate the *p*-value for nonparametric variables. Fisher's Exact test was used to calculate the significance of difference between nominal variables.

## RESULTS

Of 260 women planned for cesarean delivery, 23 who had emergency cesarean were excluded. Among the remaining 237, 156 consented for conventional care, and 81 opted for mERCD protocol. At surgery, six women in the conventional group and four in mERCD group who had intraperitoneal adhesions were excluded. The remaining 77 women in mERCD group received TAP block. Among these, seven were again excluded from the mERCD group as two women denied catheter removal at the end of 6 hours; among five women, the catheter was retained as per treating clinicians' opinion.

"Demographic Profile of the included women is shown in Table 1." In both groups, two-thirds of the cesareans [46 (65%) in mERCD and 89 (59%) in conventional groups] was repeat cesareans. Other indications were cephalopelvic disproportion [8 (11.4%) and 17 (11.3%)], placenta previa [6 (8.5%) and 7 (4.6%)], and breech in 5 (4.7%) and 7 (7.1%) in mERCD and conventional groups, respectively.

"Women receiving TAP block as per mERCD protocol had an average pain score of 4.20 compared to 6.19 in the conventional group at 6 hours ( $p = 0.005$ ) and a score of 3.71 vs. 4.1 at 24 hours (0.018). Postoperative pain scores at rest as well as with movement were significantly lesser in the mERCD group compared to the conventional protocol group (Table 2)." Time of first demand of analgesia was significantly longer in the mERCD group (7.21 hours in mERCD group compared to 4.11 hours in the conventional group) ( $p = 0.005$ ).

Though more women in mERCD group had the return of bowel sounds at 6 hours, the proportion of women who passed flatus by 6 hours was the same in both groups. Similarly, there was no difference in the recovery of bowel sounds at 24 hours; however, more women in mERCD group had passed flatus by then. None of the patients in both groups had nausea/vomiting on starting oral fluids. Between the groups, there was no difference in the time taken to pass urine after catheter removal, and one patient in mERCD group required repeat catheterization. Overall patient satisfaction as per VAS score was better in mERCD group (Table 3).

## DISCUSSION

ERAS/fast-track surgery is a concept which uses a multimodal approach including various strategies to reduce perioperative stress related to surgery and enhance recovery.<sup>9</sup>

In this study we have formulated a new method of care called multimodal Enhanced Recovery after Cesarean Delivery (ERCD) protocol by modifying the existing protocols for perioperative care. We compared the postoperative period of patients in the mERCD protocol group with patients undergoing conventional postoperative management.

The findings of studies by other researchers were consistent with the results of our study that the patients who received TAP block had less pain at rest and during movements and at different time points in the first 24 hours.<sup>6,8,10</sup> This reduction in pain with movement would encourage the patients to ambulate early. With early ambulation, there are additional benefits such as the early establishment of breastfeeding, better bonding with the newborn, early bowel movements, and reduction in thromboembolism.

Opioid analgesia is associated with adverse effects like nausea, vomiting and itching. Besides, opioids may also be transferred through breast milk to the newborn and can cause sedation and drowsiness. Transversus abdominis plane block reduced the requirement of opioid analgesia in the first 24 hours of surgery.<sup>8,10</sup>

Delay in demand for additional analgesia denoted that TAP block provided adequate analgesia at least for an average of 7 hours after the surgery. In two other Indian studies comparing TAP block with patient-controlled diclofenac + tramadol analgesia, the demand for additional analgesia in the TAP group was 9 and 12 hours.<sup>6,7</sup> They had used 15 mL of 0.5% Ropivacaine and 20 mL 0.25% of Bupivacaine, respectively. In the study by Chansoria et al.<sup>5</sup> (India), the study group received a lesser concentration of Ropivacaine (0.375%), and the time at the demand for additional analgesia (12 hours) was no different from the groups using higher concentration. The volume of the local anesthetic agent injected is more important than the concentration, as this block depends more on the spread of the local anesthetic agent.

Gum chewing is considered a type of sham feeding that improves gut motility by stimulating the cephalic vagal stimulation reflex and thereby stimulating the release of various gastric hormones. It increases intestinal motility, creates a feeling of hunger, and thus aids in the rapid return of bowel function.<sup>11</sup> In our study, there was an earlier return of gut motility in the mERCD group as observed in terms of bowel sounds at 6 hours and the passage of flatus. Other researchers who compared groups receiving chewing gum against a control observed an average of 4–5 hours of difference in the appearance of bowel sounds and 6–14 hours of difference in time to pass flatus after surgery.<sup>12,13</sup>

**Table 1:** Demographic details of study subjects

Variables	ERCD group (n = 70)	Conventional group (n = 150)	<i>p</i> value <sup>a</sup>
Age in years (mean with standard deviation)	28.02 SD 3.92	28.02 SD 2.24	0.24
Primigravida [ <i>n</i> (%)]	21 (37.3%)	56 (30%)	0.28
BMI (mean with standard deviation)	28.45 SD 2.9	29.32 SD 3.5	0.89
Period of gestation of delivery in weeks (mean with standard deviation)	37.8 SD 2.0	38.24 SD 2.5	0.67
Duration of surgery (in minutes) (mean with standard deviation)	80.05 SD 10.50	82.25 SD 9.01	0.14

<sup>a</sup>Independent samples *t*-test

**Table 2:** Comparison of pain in ERCD and conventional protocol groups

Time in hours		ERCD group (n = 70)	Conventional protocol group (n = 150)	p value <sup>a</sup>
		Mean VAS <sup>b</sup> score with standard deviation		
6 hours	At rest	4.20 SD 1.30	6.19 SD 1.26	0.005
	With movements	4.84 SD 1.25	6.35 SD 1.12	0.005
24 hours	At rest	3.71 SD 1.05	4.10 SD 1.02	0.018
	With movements	3.74 SD 0.96	4.91 SD 0.97	0.005

<sup>a</sup>Independent samples t test; <sup>b</sup>Visual analog score

**Table 3:** Comparison of recovery of bowel movements, bladder function, and overall patient satisfaction between ERCD and conventional protocol groups

Variables		ERCD group n = 70	Conventional group n = 150	p value
Return of bowel sounds <sup>a</sup> [n (%)]	6 hours	70 (100)	123 (82)	0.005
	24 hours	70 (100)	144 (96)	0.180
Passage of flatus <sup>a</sup> [n (%)]	6 hours	4 (5.7)	9 (6)	0.9
	24 hours	49 (70)	84 (56)	0.04
Time (hours) taken to pass urine after catheter removal (Mean with standard deviation) <sup>b</sup>		3.07 SD 0.84	3.10 SD 0.78	0.784
Patient satisfaction at 24 hours <sup>b</sup> (Mean)		7.02 SD 1.16	4.05 SD 1.06	0.005

<sup>a</sup>Fisher's Exact test; <sup>b</sup>Independent samples t-test

A clinical trial comparing early vs late oral feeding showed that the early oral feeding group required half the time duration as required for the late feeding group to pass flatus and have bowel sounds.<sup>14</sup> Appearance of bowel sounds and passage of flatus by 24 hours was observed in more women even when patients were started on orals as early as 2 hours after surgery compared to the delayed orals group (95 and 80% vs 22.55 and 23.5%, respectively).<sup>15</sup>

In the present study, catheter removal was done after 6 and 24 hours in mERCD group and conventional protocol group, respectively. We found no significant difference in the time taken to void urine after catheter removal. However, one woman in mERCD group had urinary retention, hence was re-catheterized. Basbug et al.<sup>16</sup> observed that urinary frequency, microscopic hematuria incidence, postoperative mobilization time, and length of hospital stay were significantly lower in the early group than in the delayed group.

Though in our study, we have not analyzed the time taken to ambulate following surgery, in mERCD group catheter was removed after 6 hours, and patients took an average of 3 hours to pass urine following catheter removal. Most patients did not opt for a bedpan that confirmed early ambulation.

In our study, the mean satisfaction score at the end of 24 hours after surgery was 7.02 in the mERCD group compared to 4.05 in the conventional protocol group. A survey in Serbia showed that women in hospitals following ERAS protocols were discharged earlier after cesarean delivery compared to NONERAS hospitals.<sup>17</sup>

Similarly, Coates et al.<sup>18</sup> showed how implementing an ERAS program increased maternal satisfaction, primarily by increasing the number of earlier discharges. Thus, satisfaction with the protocol is both immediate as well as lasting.

It would have been ideal if it was a randomized controlled study. There could be a selection bias as women could choose the protocol; obviously, women in the experimental group would be better motivated. However, the probable confounding variables were matched, and we had the control group, including double the number of women in the experimental group.

ERAS protocols consist of structured preoperative counselling which includes a detailed discussion about the components of the protocol and the effect on recovery.<sup>19</sup> In our study, the groups received preoperative counselling, including the information on the protocols' components and the advantages/disadvantages.

## CONCLUSION

Multimodal Enhanced Recovery after Cesarean Delivery protocol effectively improved women's postoperative experience by providing good analgesia and enhancing early recovery. The approach includes continuous pain relief and active measures for faster recovery.

The components are easy to implement and demand the woman's active participation. The measures are complementary to each other and boost up the individual's confidence. Transversus abdominis plane block considered in the protocol for pain relief requires training; however, it has the advantages of not having systemic side effects.

## Clinical Significance

Multimodal approach for early postcesarean recovery will enhance postoperative comfort, which is likely to minimize the duration of hospitalization and its cost. The clinicians must adopt protocols involving ERAS components tailored to the settings and the care seekers.

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