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Effect of Enhanced Recovery after Surgery (ERAS) protocol on maternal outcomes following emergency caesarean delivery: A randomized controlled trial☆

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ABSTRACT

Background: With ever increasing rates of emergency caesarean deliveries (CD),incorporating the ERAS protocol might provide a perfect window of opportunity to increase maternal comfort during the postsurgical period, but also improve outcomes and facilitate optimal return of physiological function.
Objective: To determine whether an ERAS pathway at emergency caesarean birth would permit a reduction in postoperative length of stay and improve postoperative patient satisfaction.
Material & methods: Patients undergoing emergent caesarean delivery at ≥ 34 weeks of gestation were randomized to ERAS or conventional care. The primary outcome was to compare postoperative length of hospital stay. Secondary outcome variables included first oral intake, passage of flatus/defecation, first ambulation, first urination after catheter removal and postoperative pain scores in both groups.
Results: We randomized 142 women (71 each in ERAS versus Conventional arm) undergoing emergency cesarean delivery. Incorporation of ERAS protocol resulted in shorter length of hospital stay (73.92 ± 8.96 in conventional arm vs 53.87 ± 15.02 in ERAS arm; p value <.0001). Significant difference was seen in visual analogue scoring during initial ambulation and rest on day 0 and day 1 between ERAS and conventional arms with mean scores being lower in ERAS arm compared to Conventional arm (p value <.05). In terms of quality of life, ERAS arm had better quality of life compared to conventional arm
Conclusion: Incorporation of ERAS protocol in emergency caesarean definitely improves patient outcome in terms of early resumption of activities with better quality of life.

1. Introduction

Enhanced Recovery after Surgery (ERAS) is a multidisciplinary patient care model based on evidence-based protocols with an aim to reduce surgical stress response and thereby improve post-operative outcome. European anaesthesiologists and surgeons are known to be the pioneers of ERAS model, most notably a Dutch professor, Henrik Kehlet, who challenged the traditional paradigms of perioperative care with the concept of multimodal surgical care. [1] Colorectal surgery is considered to be first surgical subspecialty wherein ERAS pathways were implemented in year 1999 and since then, this model has found widespread use in other surgical specialities including urology, orthopaedics, breast surgery and gynaecological surgery that have reported quite similar patient related outcomes.[2–4] Despite the widespread use of ERAS with evidence supporting its effectiveness in various specialities, literature is still lagging regarding its use in obstetrical procedures. Caesarean delivery (CD) remains one of the commonest surgical procedure in obstetrical practice. Compared to women who deliver vaginally, women undergoing caesarean section have longer hospital stay, less patient satisfaction and delayed functional and physiological recovery. Herein the patient population is a young, healthy lady with ability to achieve faster recovery to baseline so as to provide care to her new-born child. [5] With ever increasing rates of caesarean deliveries, incorporating the ERAS protocol might provide a perfect window of opportunity to increase maternal comfort during the postsurgical period, but also improve outcomes and facilitate optimal return of

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physiological function. The use of ERAS in Caesarean sections is still developing. The ERAS Society recently developed evidence-based guidelines for scheduled and unscheduled caesarean deliveries preoperative, intraoperative, and postoperative phases. [6–8].

The goal of the current study was to assess the effectiveness and practicability of using the ERAS protocol in the surgical management of women undergoing emergency caesarean deliveries at a tertiary hospital and to ascertain its effect on outcomes like length of hospital stay, resumption to bladder/bowel habits, post-operative complications and quality of life.

2. Material & methods

This was an 18-month prospective randomised controlled trial being carried out at a tertiary care facility in North India (May 2021 to October 2022). Prior to patient enrolment, informed consent was obtained from each participant, and the study was started with approval from the Institutional Ethics Committee. CTRI registration was obtained (CTRI/2021/04/033288 dated 30/04/2021). Women were eligible for enrolment if they had a gestational age $\geq$ 34 completed weeks based on the last menstrual period or first trimester ultrasound scan (if available) and were undergoing emergency caesarean delivery. Cases with gestational age less than 34 weeks of gestation or those who had undergone two or more caesarean sections previously, had history of rupture uterus, pre-existing hypertension, or pregnancy-induced hypertension preoperatively or those diagnosed with placenta accreta spectrum that could potentially prolong their hospital stay were excluded from study. Patients planned for elective caesarean delivery were also excluded.

Intervention: ERAS vs Conventional arm.

ERAS arm: Components of ERAS includes preoperative, intraoperative and postoperative. However, in emergency settings preoperative component couldn't be included. Therefore, as patients in our study underwent an emergency caesarean delivery, they received only the intraoperative and postoperative components Table 1.

Major components of the ERAS arm were based on evidence based guidelines for caesarean deliveries by ERAS Society and Society of Obstetric Anaesthesia and Perinatology (SOAP) with certain modifications in antibiotic treatment [9].

Conventional arm: For patients in the conventional arm, usual institutional protocols were followed like intravenous fluids were given at 100 mL/hr postoperatively (typical duration 24 h) till oral liquids tolerated, mobilization was as per patient and treating doctor's discretion, Foley's catheter removed within 24–48 h of surgery, dressing changed at day 3 and injectable antibiotics and analgesics continued for 48 h postoperatively followed by five days oral antibiotics.

The day of surgery was taken as day 0 and subsequently day 1 and day 2/3. The primary clinical outcome was postoperative hospital stay and secondary outcomes included first oral intake, passage of flatus/defecation, first ambulation, first urination after catheter removal, postoperative pain scoring according to visual analogue scale (VAS score) at rest and during breastfeeding on Day 0 and Day 1 of surgery postoperative complications (fever, urinary retention, re-catheterization, urinary tract infection, nausea and vomiting, spinal headache, paralytic ileus), readmissions rate - within 30 days of caesarean section and Quality of life (QOL)- using EQ-5D-5 L questionnaire.[10] Discharge practices depends on various factors including sociodemographic characteristics, surgical morbidity, maternal satisfaction and neonatal care. As this study was conducted in a tertiary centre catering to hilly region of North India many times patients were admitted for longer periods until neonate was discharged. Hence we calculated length of stay using fit for discharge criteria and in terms of overall stay. A patient was considered fit for discharge if she was ambulating, tolerating normal diet, urinating and pain was tolerable with oral medications.

EQ-5D-5 L questionnaire was used to assess quality of life. [10] The EQ-5D is a two-piece questionnaire. A self-assessment of one's current health along five pre-specified dimensions—mobility, self-care, typical activity, pain or discomfort, and anxiety or depression—makes up the first part of the descriptive system. The respondent choses one of the following five response levels for each dimension in the 5 L version: nil, slight, moderate, severe, or extreme issues. The visual analogue scale (VAS), which is part of the EQ-5D, allows users to visually guide their self-rating of their present health on a scale from 0 (worst) to 100 (best). QOL was assessed at day 0, day 1, day 2 and on the day of discharge, day 7–10 and 6 weeks postpartum. Postoperative telephone surveys were conducted at 7–10 days and 6 weeks postpartum for QOL.

Sample Size calculation was based on a previous study wherein the length of hospital stay for emergency caesarean section in pre-implementation and post implementation of ERAS arm was 3.1 $\pm$ 1.2 days and 2.5 $\pm$ 0.7 days respectively. [11] Taking these values as reference, the minimum required sample size with 95% power of study and 5% level of significance was 70 patients in each study group. Total sample size taken was 142 (71 patients per group).

After fulfilling the above selection criteria, patients were randomized using computer generated random sequence allocation as 1:1 into two groups: ERAS arm and Conventional arm. Allocation concealment was done using identical, sealed, sequentially numbered, opaque envelopes which had either E or C written on them. Group enrolment was done when the case was prepared for emergency caesarean section for indication as per defined inclusion criteria.

The Statistical Package for Social Sciences (SPSS) program, developed by IBM and manufactured in Chicago, USA, version 25.0, was used for the final analysis. [12] A p value of less than 0.05 was regarded as statistically significant. Differences between two were analysed using Mann-Whitney Test for quantitative and not normally distributed data whereas variables which were quantitative and normally distributed were analysed using Independent-t test. Chi-Square test was used for comparing qualitative variables.

3. Results

During the study period of 18 months from May 2021 to October

Table 1
Major components in ERAS protocol.

Intravenous fluids: Goal-directed therapy (1 mL/kg/hr, target urine output as 0.3 - 0.5 mL/kg/hr) intravenous fluids to stop once patient is tolerating oral fluid or at 12 h postoperatively
Early mobilization:0-8hrs Post-op: Patient is encouraged to sit on edge of bed, out of bed to chair, ambulation as tolerated; 8-24hrs Post-op: Ambulation as tolerated, Walking: 1-2 times (or more); 24-48hrs Post-op: Walking: 3-4 times (or more) in a day
Early feeding: Sips of water within 2 h of shifting out from OT. Initiate regular feeding within 8 h of surgery. Chewing gum every 8 h.
Early urinary catheter removal- at 8-12 h postpartum
Injection Ceftriaxone 1 gm iv twice daily X 24 h followed by Tab Cefixime 200 mg twice daily for five days
Infusion Metronidazole 500 mg/100 mL infusion Iv thrice daily X 24 h
Intravenous paracetamol for 24 h postoperatively followed by oral dose as desired
Intravenous diclofenac for 24 h postoperatively followed by oral dose as desired
Additional analgesic- **Inj. Tramadol hydrochloride** 100 mg as and when needed
Incentive spirometry
Early dressing change at 24 h

2022, 186 women undergoing emergency caesarean delivery were assessed for eligibility. Amongst these 44 women were excluded as they did not meet the inclusion criteria. Finally 142 women were randomised in 1: 1 allocation into ERAS and Conventional arm (71 in each group). There were no protocol deviations or lost to follow up in each arm. (Fig. 1) Both arms were similar in baseline and clinical characteristics. (Table 2).

Table 3 shows the primary and secondary outcome analysis of this study. Incorporation of ERAS protocol resulted in shorter length of hospital stay when decided based on fit for discharge criteria (73.92 ± 8.96 vs in conventional arm vs ERAS group 53.87 ± 15.02; *p* value <.0001). Even the overall length of hospital stay was significantly shorter in ERAS arm (5.32 ± 2.75 vs7.86 ± 7.01 in conventional arm, p = 0.006). Mean ± SD of time of first liquid meal, time of first semi-solid food, time to normal food, time of catheter removal (in hours), time to first ambulation (in hours), time to passing flatus, time to passing stool in conventional arm was 16.89 ± 6.21, 26.06 ± 6.86, 38.59 ± 12.5, 22.8 ± 3.01, 23.73 ± 4.57,35.51 ± 8.86, 66.42 ± 13.17 respectively which was significantly higher as compared to ERAS group (3.3 ± 1.16(*p* value<.0001), 8.58 ± 3.12(*p* value<.0001), 16.94 ± 5.86 (*p* value<.0001), 6.07 ± 1.1(*p* value<.0001), 8.62 ± 1.96(*p* value<.0001), 21.68 ± 8.34(*p* value<.0001), 50.3 ± 18.67(*p* value<.0001)) respectively. No significant difference was seen in terms of postoperative complications and readmission rates between the two arms.

Significant difference was seen in visual analogue scoring during initial ambulation and rest on day 0 and day 1 between ERAS and conventional arms with mean scores being lower in ERAS arm compared to Conventional arm (*p* value <.05). Women in ERAS arm had lesser pain scores during breastfeeding (6.7 ± 1.07 on day 0 and 5.07 ± 1 on day 1) compared to conventional arm (7.3 ± 1.02 and 5.89 ± 0.89), difference being statistically significant. (Table 4).

The percentages of women reporting problem levels 1 to 5 for each of the five health dimensions of the EQ-5D-5 L questionnaire are shown in Table 5. Within the first week of birth, the proportion of women reporting no/slight problems were substantially higher in ERAS vs conventional arm. The health status remained significantly better in ERAS arm at day 7–10 and at 6 weeks postpartum. Anxiety or depression was the only reported dimension having comparable Qol in both arms.

Table 2
Baseline Demographic & Clinical characteristics.

Characteristic	ERAS (n = 71)	Conventional (n = 71)	p value
Age (Mean ± SD)	26.52 ± 4.59	27.3 ± 4.29	0.301‡
Education			
High school	5 (7.04%)	3 (4.23%)	0.844
Intermediate	27 (38.03%)	25 (35.21%)	*
Graduate	32 (45.07%)	34 (47.89%)	
Professional degree	7 (9.86%)	9 (12.68%)	
Parity			
P0	38 (53.52%)	28 (39.44%)	0.113
P1	31 (43.66%)	35 (49.30%)	*
P2	2 (2.82%)	6 (8.45%)	
P3	0 (0%)	2 (2.82%)	
Gestational age(weeks) (Mean ± SD)	38.09 ± 1.82	37.73 ± 1.99	0.26‡
Body mass index(kg/m^2) (Mean ± SD)	25.85 ± 1.67	25.55 ± 1.84	0.303‡
Pre-operative hemoglobin(gm/dL)(Mean ± SD)	11.65 ± 1.51	11.45 ± 1.61	0.453‡
Post-operative hemoglobin(gm/dL) (Mean ± SD)	10.63 ± 1.41	10.34 ± 1.47	0.234‡
Blood loss during surgery(mL) (Mean ± SD)	489.93 ± 94.22	508.38 ± 113.66	0.294‡

‡ Independent t test, * Fisher's exact test

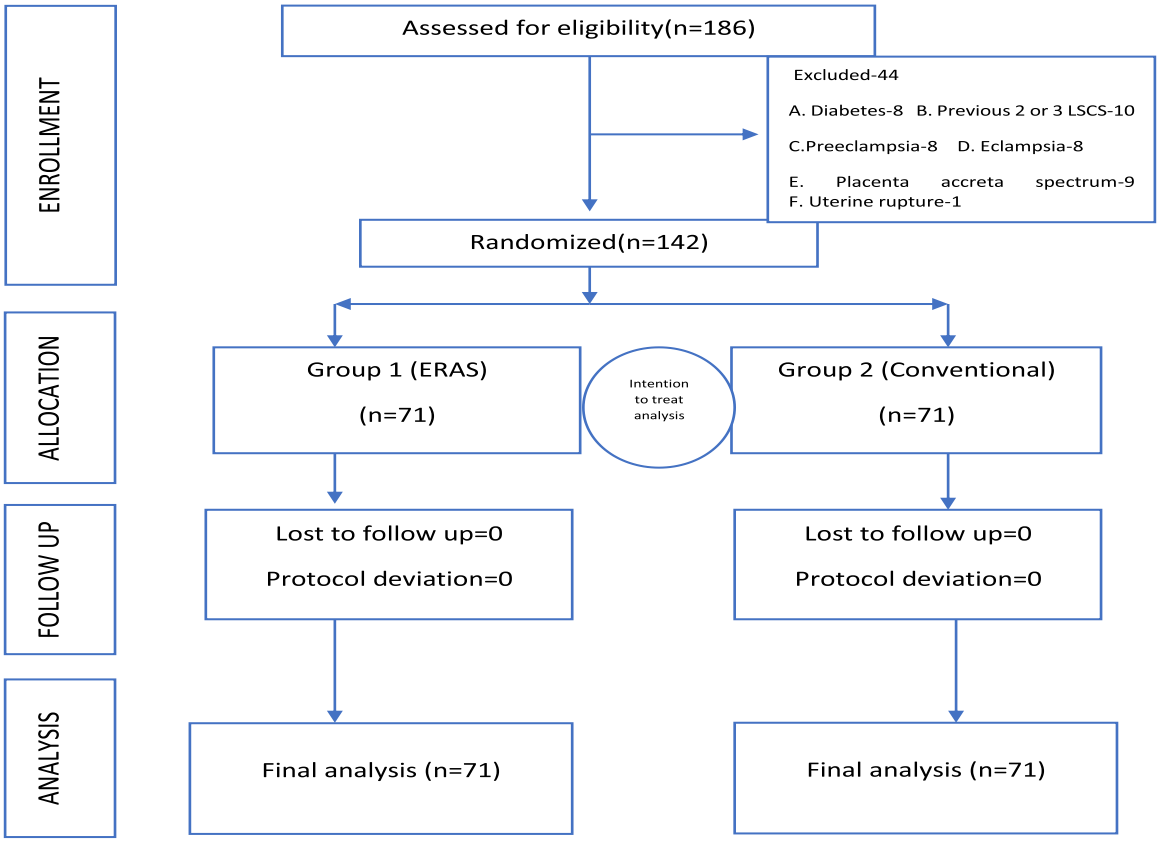

Fig. 1. Algorithm of Randomization.

Table 3
Primary & Secondary Outcome.

Outcome (Mean ± SD)	ERAS (n = 71)	Conventional (n = 71)	p value
Fit for discharge in hours	53.87 ± 15.02	73.92 ± 8.96	< .0001‡
Overall Hospital Stay in days	5.32 ± 2.75	7.86 ± 7.01	0.006‡
Time of first liquid meal(hours after OT)	3.3 ± 1.16	16.89 ± 6.21	< .0001‡
Time of first semisolid food(in hours)	8.58 ± 3.12	26.06 ± 6.86	< .0001‡
Time to normal food(in hours)	16.94 ± 5.86	38.59 ± 12.5	< .0001‡
Time of catheter removal(in hours)	6.07 ± 1.1	22.8 ± 3.01	< .0001‡
Time to first ambulation(in hours)	8.62 ± 1.96	23.73 ± 4.57	< .0001‡
Time to passing flatus(in hours)	21.68 ± 8.34	35.51 ± 8.86	< .0001‡
Time to passing stool(in hours)	50.3 ± 18.67	66.42 ± 13.17	< .0001‡
Postoperative complications			
Spinal headache	0(0%)	2(2.82%)	0.496 *
Readmission within 30 days	1 (1.41%)	0 (0%)	1 *

‡ Independent t test, * Fisher's exact test

Table 4
Comparison of Pain scores during initial ambulation, at rest and during breastfeeding.

VAS score	ERAS (n = 71)	Conventional (n = 71)	p value
Pain during initial ambulation	9.35 ± 1.06	9.86 ± 0.52	0.0004‡
Pain at rest on Day 0	8.08 ± 1.09	8.96 ± 1.01	< .0001§
Pain at rest on Day 1	6.14 ± 0.85	6.87 ± 1.05	< .0001§
Pain during breastfeeding on Day 0	6.7 ± 1.07	7.3 ± 1.02	0.002§
Pain during breastfeeding on Day 1	5.07 ± 1	5.89 ± 0.89	< .0001§

‡ Independent t test, § Mann Whitney test

4. Discussion

4.1. Principal findings of the study

The use of ERAS in this study had demonstrated its value in enhancing post-operative outcomes and lowering hospitalization duration. We observed that, when correctly applied, the ERAS program results in a quicker recovery and earlier discharge and, ultimately, increased quality of life and patient satisfaction even in emergency caesarean deliveries. Incorporation of ERAS protocol in emergency caesarean deliveries resulted in shorter hospital stay when fit for discharge criteria was applied compared with conventional care (53.87 ± 15.02 vs 73.92 ± 8.96). Patients in the ERAS arm tolerated early mobilization well, ate well on the day of surgery, and saw a quicker recovery of bowel and bladder function. No readmission was seen in the ERAS arm. They had lower pain scores at rest and during ambulation & breastfeeding compared to conventional arm.

5. Results

The findings of shorter hospital stay and better quality of life in women receiving ERAS protocol during emergency caesarean delivery supports our hypothesis. We used fit for discharge criteria for considering a women fit for discharge. Ours is a tertiary centre catering to people living in hilly areas from Uttarakhand, India. Difficult roads with dangerous terrain make it problematic for patients to visit hospital regularly, so many a times they stay for a longer duration at hospital. Discharge practices depends on various factors including sociodemographic characteristics, surgical morbidity, maternal satisfaction and neonatal care. ERAS is a novel approach focusing on improved patient outcome. Discharge planning needs to focus on maternal satisfaction and neonatal aspect along with lactation and contraceptive planning. Shared decision making plays a crucial role in quality care in maternity services. It decreases decisional conflict thereby increasing maternal delivery satisfaction. [13] We considered a women fit for discharge if she was ambulating, urinating, tolerating general diet, and pain was well controlled with oral medications before discharge. Following the success of fast-track pathways (FTPs) facilitating early day 1 discharge in various specialties, a few recent studies have incorporated its concept in elective caesarean deliveries and concluded it as a safe and desirable option in low risk caesarean deliveries. This study was planned following development of recently published ERAS guidelines (intra-operative and postoperative components by Caughey et al., and

Table 5
Comparison of QOL by EQ5D health dimension.

Health dimension	Problem level	Day 2 postpartum			Day of discharge			7-10 day postpartum			6 weeks postpartum		
		E (%)	C (%)	P	E (%)	C (%)	P	E (%)	C (%)	P	E (%)	C (%)	P
Mobility	No problem	0	0	< 0.0001 *	11.27	0	< 0.0001 *	52.11	18.31	< 0.0001 *	98.59	39.44	< 0.0001 *
	Slight problem	5.63	1.41		60.56	18.31		46.48	28.17		1.41	47.89	
	Moderate problem	71.83	28.17		28.17	61.97		1.41	50.7		0	12.68	
	Severe problem	22.54	69.01		0	19.72		0	2.82		0	0	
	Extreme problem	0	1.41		0	0		0	0		0	0	
Self-care	No problem	1.41	0	< 0.0001 *	21.13	0	< 0.0001 *	61.97	23.94	< 0.0001 *	95.77	57.75	< 0.0001 *
	Slight problem	28.17	7.04		67.61	21.13		36.62	38.03		4.23	42.25	
	Moderate problem	57.75	49.3		11.27	70.42		1.41	36.62		0	0	
	Severe problem	12.68	43.66		0	8.45		0	1.41		0	0	
	Extreme problem	0	0		0	0		0	0		0	0	
Usual activities	No problem	0	0	< .0001†	18.31	2.82	< .0001†	63.38	22.54	< 0.0001 *	88.73	60.56	0.0002 *
	Slight problem	29.58	7.04		54.93	29.58		35.21	40.85		11.27	38.03	
	Moderate problem	56.34	49.3		26.76	52.11		1.41	35.21		0	1.41	
	Severe problem	14.08	43.66		0	15.49		0	1.41		0	0	
	Extreme problem	0	0		0	0		0	0		0	0	
Pain/ discomfort	No problem	1.41	0	< 0.0001 *	15.49	1.41	< 0.0001 *	63.38	25.35	< .0001†	87.32	60.56	0.0007 *
	Slight problem	35.21	5.63		76.06	33.8		35.21	47.89		11.27	35.21	
	Moderate problem	57.75	59.15		8.45	61.97		1.41	26.76		1.41	4.23	
	Severe problem	5.63	35.21		0	2.82		0	0		0	0	
	Extreme problem	0	0		0	0		0	0		0	0	
Anxiety/ depression	No problem	100	88.73	0.006 *	100	98.59	1*	98.59	98.59	1 *	98.59	100	1 *
	Slight problem	0	11.27		0	1.41		1.41	1.41		1.41	0	
	Moderate problem	0	0		0	0		0	0		0	0	
	Severe problem	0	0		0	0		0	0		0	0	
	Extreme problem	0	0		0	0		0	0		0	0	

* Fisher's exact test, † Chi square test, E- ERAS Arm, C- Conventional Arm

Macones et al. [7,8] The authors in these guidelines suggest multimodal postoperative analgesics in the form of NSAIDs and paracetamol but this is a routine practice in our centre hence both arms received this. They suggested immediate catheter removal following caesarean section but we removed catheter at 8–12 h postoperative or even slightly earlier based on the patient's condition.

Studies focussing on benefit of ERAS protocol in emergency caesarean deliveries are limited. In a retrospective cohort study by Fay et al., it was observed that enhanced recovery after surgery in caesarean delivery had significantly shorter postoperative hospital stay by 7.8% or 4.86 h overall (P < .001) and for both elective (P¼.001) and emergency (P¼.002) caesarean delivery. [14] In a RCT done at a referral centre at Uganda, authors observed shorter hospital stay for ERAS arm compared to standard protocol arm by a difference of − 18.5 h (P < .001, 95% confidence interval [CI], −23.67, −13.34). [15] In a recent systematic review and meta-analysis by Sultan P et al. in 2021 including twelve studies with 17,607 patients (9693 without ERAS and 7914 with ERAS) noted that mean hospital stay in ERAS group was 0.51 days lesser compared to control group (95% CI 0.94 days lower to 0.09 days higher). [16] In another systematic review and meta- analysis by Meng X et al., six studies with appropriate data reporting length of hospital stay was analyzed. The authors concluded that there was a shorter LOS in ERAS group compared to conventional approach (Weighted mean difference −7.47 h, 95% CI: −8.36 to −6.59 h, $p < 0.00001$). [17].

In our study, we found that women in ERAS arm had better recovery in terms of early resumption to normal food (16.94 ± 5.86 vs 38.59 ± 12.5), early ambulation (8.62 ± 1.96 vs 23.73 ± 4.57) and catheter removal (6.07 ± 1.1 vs 22.8 ± 3.01) compared to conventional arm, difference being statistically significant. Various other studies have reported better functional recovery in ERAS group. In a recent Indian study by Gupta S et al. for women undergoing elective caesarean section, women in ERAS group had early ambulation compared to standard protocol (7.73 ± 1.80 vs 63.63 ± 6.76, $p < 0.0001$).[18] They observed that return to semisolid food intake was also faster in ERAS compared to standard protocol group (7.91 ± 0.75 vs 33.14 ± 4.97 hrs). 92/100 women had mobilised within 6–10 h of surgery and early catheter removal done in 98/100 women within 6–10 h of surgery.

We found no significant difference in terms of blood loss, postoperative complications and readmission rates in both arms. This was comparable to that noted by Teigen NC et al. and Kleiman AM et al. [19,20]. Women in ERAS arm had better pain scores at rest and during ambulation compared to conventional arm in our analysis. This was contrary to that noted by Lester SA et al. wherein there was no significant difference in terms of pain scores on day 0–3 in both groups. [21] Laronche A et al. also observed no significant difference in pain scores at rest on day 1 and day 3 in both groups, but there was a significant reduction in pain rating on mobilisation in ERAS group compared to conventional group on day 3. [22] They also noted that patients in ERAS group had positive feelings towards the new-born with better satisfaction scores compared to conventional but we didn't analyse this aspect and focused on maternal quality of life in our study.

5.1. Clinical implications

Considering CD to be the commonest surgical procedure in obstetrics practice and with its rising prevalence, incorporating ERAS in emergency setting will benefit young women in earlier resumption to usual activities and better health status.

5.2. Research implications

In this study we evaluated quality of life using a standard questionnaire (EQ-5D-5 L) and observed a significantly better quality of life in ERAS arm versus conventional arm in women undergoing emergency CD. To the best of our knowledge and literature search, we didn't find any study analyzing quality of life in these arms but further large scale multicentric studies are needed to focus on this aspect of emergency CD.

5.3. Strengths and limitations

A major drawback of this study is that it was a single center study and hence, generalizing the findings to the rest of the population is not possible, necessitating the need for large scale multicentric studies. Despite this possible drawback, it is significant to note that relatively few studies from literature till date have examined how ERAS and the standard approach are implemented in emergency caesarean birth. In actuality, this work has barely been explored in Indian studies and hence we hope that findings of this well powered randomized controlled trial will help others to incorporate ERAS protocols in emergency caesarean delivery to improve maternal outcomes and quality of life.

6. Conclusion

We observed that, when correctly applied, the ERAS program results in a quicker recovery and earlier discharge and, ultimately, increased quality of life and patient satisfaction even in emergency caesarean deliveries.

Ethical Clearance

Study was approved by the Institution Ethics Committee vide Letter No. AIIMS/IEC/21/115 dated 12/03/2021.

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CRediT authorship contribution statement

Dipesh Kumar Gupta: Writing – original draft, Supervision, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Anupama Bahadur:** Writing – review & editing, Visualization, Supervision, Methodology, Investigation, Formal analysis, Data curation. **Ajit Kumar:** Supervision, Project administration, Methodology, Investigation, Data curation. **Rakesh Kumar:** Writing – review & editing, Writing – original draft, Software, Conceptualization. **Rajlaxmi Mundhra:** Writing – review & editing, Writing – original draft, Visualization, Supervision, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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