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Research Article

A Prospective Comparative Study of Enhanced Recovery After Surgery Versus Standard Care in Elective Caesarean Section

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Abstract: ***Introduction:*** Enhanced Recovery After Surgery (ERAS) protocols are evidence-based perioperative care pathways designed to reduce surgical stress, improve recovery, and minimize postoperative complications. Although ERAS has been widely adopted in several surgical specialties, its application in caesarean section remains limited in many tertiary care settings in India. **Objectives:** To assess the feasibility of the ERAS protocol and to compare ERAS with standard perioperative care in elective and scheduled caesarean section with respect to postoperative pain, recovery parameters, length of hospital stay, and postoperative complications. **Methods:** This prospective comparative study was conducted over a six-month period at a tertiary care hospital. A total of 100 antenatal women undergoing elective or scheduled caesarean section were enrolled and allocated into two groups: ERAS group (n = 50) and standard care group (n = 50). Baseline demographic characteristics were comparable between groups. Postoperative pain was assessed using the Visual Analog Scale (VAS) at 12 and 24 hours. Recovery parameters and postoperative complications were recorded and compared. Statistical analysis was performed using appropriate tests, with $p < 0.05$ considered significant. **Results:** Age distribution was similar between the two groups ($p = 0.416$). The ERAS group demonstrated significantly lower mean VAS scores at both 12 hours (4.20 ± 0.87 vs 7.59 ± 0.98) and 24 hours (2.02 ± 0.81 vs 5.45 ± 0.90) compared to the control group ($p < 0.001$). Early ambulation, initiation of oral feeds, catheter removal, and discharge were achieved earlier in the ERAS group. Postoperative complications were markedly fewer in the ERAS group, with only one case of fever (2.0%) reported. **Conclusion:** Implementation of the ERAS protocol in caesarean section is feasible and is associated with improved pain control, faster recovery, shorter hospital stay, and reduced postoperative morbidity compared to standard care.

Keywords: Enhanced Recovery After Surgery; Caesarean Section; Postoperative Pain; Early Mobilization; Maternal Outcomes

INTRODUCTION

Caesarean section is one of the most performed surgical procedures worldwide, with a steady increase in rates observed across both developed and developing countries [1]. Although caesarean delivery is often lifesaving for the mother and fetus, conventional perioperative care is frequently associated with significant postoperative pain, delayed mobilization, prolonged hospital stay, and increased maternal morbidity, thereby placing a substantial burden on healthcare systems [2,3].

Improving postoperative recovery and minimizing procedure-related complications have therefore become key priorities in contemporary obstetric practice.Enhanced Recovery After Surgery (ERAS) is a structured, multimodal, evidence-based perioperative care pathway designed to attenuate the physiological stress response to surgery and facilitate early return to normal function. Core elements of ERAS include preoperative counseling, reduced fasting duration, multimodal analgesia, maintenance of normothermia, early ambulation, and early initiation of oral feeding [4,5]. Originally developed for colorectal surgery, ERAS protocols have demonstrated consistent benefits across multiple surgical specialties, including reduced postoperative pain, shorter hospital stay, lower complication rates, and improved patient satisfaction [5].In obstetrics, the adaptation of ERAS principles to caesarean delivery—commonly referred to as Enhanced Recovery After Caesarean (ERAC)—has gained increasing attention in recent years. Systematic reviews and meta-analyses have shown that ERAC protocols are associated with improved maternal outcomes, earlier recovery, and reduced length of hospital stay when compared with conventional perioperative care [1,2]. Professional obstetric and anesthetic societies now recommend ERAC as part of standard perioperative management for caesarean section [3,4]. However, real-world implementation remains inconsistent, particularly in low- and middle-income countries, due to concerns regarding feasibility, safety, and institutional adherence

[6].There is limited prospective evidence from Indian tertiary care hospitals comparing ERAS protocols with standard perioperative care in elective caesarean sections. Generating locally relevant data is essential to support wider adoption and integration of ERAC pathways into routine obstetric practice.The present study was undertaken to assess the feasibility of implementing an ERAS protocol in elective caesarean section and to compare its impact on postoperative pain, recovery parameters, length of hospital stay, and postoperative complications with those of standard perioperative care.

MATERIALS AND METHODS

Study Design and Setting

This prospective comparative study was conducted in the Department of Obstetrics and Gynaecology at Government General Hospital, Kurnool over a period of six months, from March 2025 to August 2025. The study aimed to compare outcomes of an Enhanced Recovery After Surgery (ERAS) protocol with standard perioperative care in women undergoing elective or scheduled caesarean section.

Study Population and Sample Size

A total of 100 antenatal women with singleton pregnancies at ≥37 weeks of gestation who were planned for elective or scheduled caesarean section were enrolled after obtaining informed consent. Participants were allocated into two groups: the ERAS group (n = 50) and the standard care group (n = 50).

Inclusion Criteria

Women with singleton pregnancy beyond 37 weeks of gestation undergoing elective or scheduled caesarean section and willing to participate in the study were included.

Exclusion Criteria

Women undergoing emergency caesarean section, those with significant medical disorders such as diabetes mellitus, hypertension, cardiac, renal, or pulmonary diseases, and women with obstetric complications including placenta previa, multiple gestation, severe anemia, advanced maternal age, or bleeding disorders were excluded.

Intervention Protocols

ERAS Protocol:

The ERAS group received standardized perioperative care that included preoperative counseling, shortened fasting (clear liquids up to 6 hours and solids up to 8 hours), carbohydrate loading two hours prior to surgery, maintenance of intraoperative normothermia, regional anesthesia, multimodal analgesia, early initiation of oral feeding, early ambulation, and early removal of urinary catheter.

Standard Care Protocol:

The control group received conventional perioperative care, which included prolonged fasting, routine intraoperative and postoperative management, delayed initiation of oral feeds, later ambulation, delayed catheter removal, and discharge as per standard institutional practice.

Outcome Measures

Primary outcomes included postoperative pain assessed using the Visual Analog Scale (VAS) at 12 and 24 hours, length of hospital stay, and time to functional recovery. Secondary outcomes included postoperative complications such as hypotension, postoperative nausea and vomiting, fever, wound infection, and urinary retention.

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using appropriate statistical software. Continuous variables were expressed as mean ± standard deviation, and categorical variables as frequencies and percentages. Independent t-test and chi-square test were used for comparison between groups. A p-value of <0.05 was considered statistically significant.

Ethical Considerations

The study was approved by the Institutional Ethics Committee, Kurnool Medical college, Kurnool and written informed consent was obtained from all participants prior to enrollment.

RESULTS

A total of 100 women undergoing elective or scheduled caesarean section were included in the study, with 50 participants managed under the Enhanced Recovery After Surgery (ERAS) protocol and 50 receiving standard perioperative care.

Baseline age distribution

The age distribution of participants was comparable between the two groups. Most women belonged to the 21–25-year age group, accounting for 47.0% of the total study population, followed by the 26–30-year group (44.0%). Only 9.0% of participants were aged between 31 and 35 years. There was no statistically significant difference in age distribution between the ERAS and control groups ($\chi^2 = 2.845$, $p = 0.416$), indicating adequate baseline comparability (Table 1).

Table 1. Age Distribution of Study Participants in ERAS and Control Groups

Age group (years)	ERAS (n = 50) n (%)	Control (n = 50) n (%)	Total (n = 100) n (%)
21–25	24 (48.0)	23 (46.0)	47 (47.0)
26–30	22 (44.0)	22 (44.0)	44 (44.0)

31–35	4 (8.0)	5 (10.0)	9 (9.0)
Total	50 (100)	50 (100)	100 (100)

Chi-square value = 2.845, p = 0.416

Postoperative pain assessment

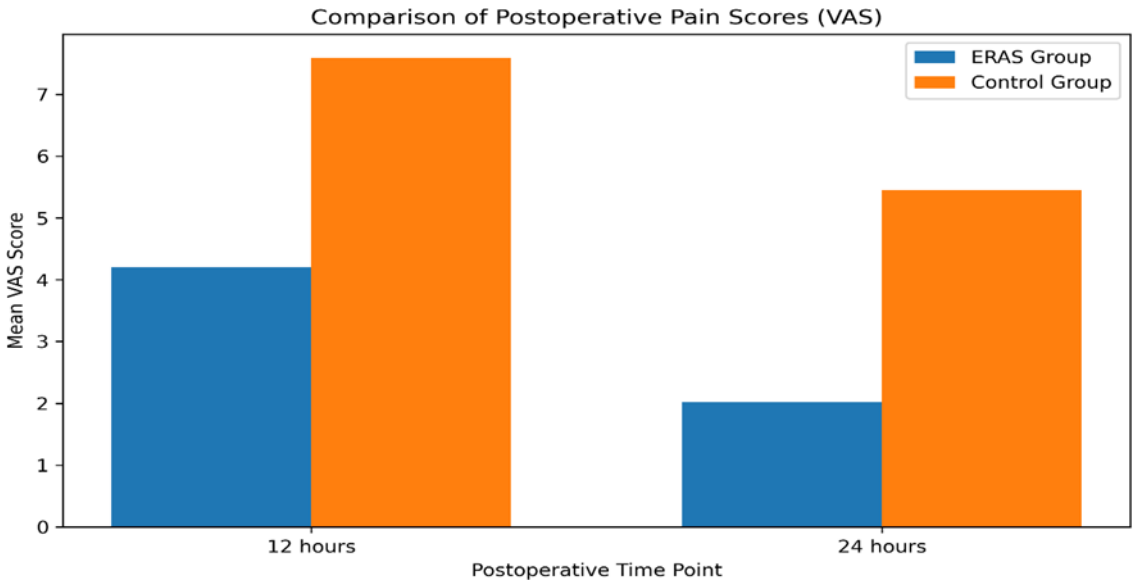
Postoperative pain was assessed using the Visual Analog Scale (VAS) at 12 and 24 hours following surgery. The ERAS group demonstrated significantly lower mean VAS scores at both time points compared with the control group. At 12 hours postoperatively, the mean VAS score was 4.20 ± 0.87 in the ERAS group versus 7.59 ± 0.98 in the control group ($t = 18.429$, $p < 0.001$). Similarly, at 24 hours, pain scores were significantly lower in the ERAS group (2.02 ± 0.81) compared to the control group (5.45 ± 0.90) ($t = 20.196$, $p < 0.001$), reflecting superior pain control with the ERAS protocol (Table 2).

Table 2. Postoperative Pain Scores (VAS) at 12 and 24 Hours

Time point	ERAS (Mean ± SD)	Control (Mean ± SD)	t-value	p-value
VAS score at 12 hours	4.20 ± 0.87	7.59 ± 0.98	18.429	<0.001
VAS score at 24 hours	2.02 ± 0.81	5.45 ± 0.90	20.196	<0.001

ERAS group demonstratd significantly lower pain scores at both postoperative intervals.

Figure 1. Comparison of postoperative pain scores (VAS) between ERAS and standard care groups at 12 and 24 hours following caesarean section.



Recovery parameters

Women managed under the ERAS protocol achieved key postoperative recovery milestones earlier than those receiving standard care. Early ambulation was initiated within 2–6 hours in the ERAS group, whereas it was delayed up to 24–48 hours in the control group. Oral feeding was started by 6 hours postoperatively in the ERAS group, compared to initiation after 48 hours in the control group. Urinary catheter removal, suture removal, and hospital discharge also occurred earlier in the ERAS group, indicating faster functional recovery and shorter hospital stay (Table 3).

Table 3. Recovery Parameters in ERAS and Standard Care Groups

Recovery parameter	ERAS (n = 50)	Control (n = 50)
Time to ambulation	Within 2–6 hours	After 24–48 hours
Initiation of oral feeds	Liquids by 6 hours	After 48 hours
Urinary catheter removal	Within 12 hours	After 48 hours
Suture removal	POD 5	POD 7
Discharge from hospital	POD 3–5	POD 7

Early mobilization, feeding, and discharge were consistently achieved in the ERAS group.

Postoperative complications

The incidence of postoperative complications was markedly lower in the ERAS group. Only one case (2.0%) of postoperative fever was observed, with no occurrences of hypotension, postoperative nausea and vomiting, wound infection, or urinary retention. In contrast, the control group experienced higher complication rates, including hypotension (22.0%), postoperative nausea and vomiting (16.0%), fever (12.0%), wound infection (6.0%), and urinary retention (8.0%). Overall postoperative morbidity was substantially reduced among women managed with the ERAS protocol (Table 4).

Table 4. Postoperative Complications

Complication	ERAS (n = 50), n (%)	Control (n = 50), n (%)
Hypotension	0 (0.0)	11 (22.0)
Postoperative nausea/vomiting	0 (0.0)	8 (16.0)
Fever	1 (2.0)	6 (12.0)
Wound infection	0 (0.0)	3 (6.0)
Urinary retention	0 (0.0)	4 (8.0)

Overall postoperative morbidity was markedly lower in the ERAS group.

DISCUSSION

The present prospective comparative study assessed the effectiveness of the Enhanced Recovery After Surgery (ERAS) protocol in women undergoing elective caesarean section and demonstrated significant advantages over conventional perioperative care. The findings confirm that ERAS implementation is feasible in a tertiary care setting and is associated with improved postoperative pain control, faster functional recovery, and reduced postoperative morbidity, consistent with evidence reported in earlier comparative and observational studies [7,9,12].Baseline demographic characteristics, particularly age distribution, were comparable between the ERAS and control groups, minimizing selection bias and strengthening the validity of outcome comparisons. The predominance of women in the younger reproductive age group reflects the typical obstetric population undergoing elective caesarean section and is in line with previous ERAS-related studies in obstetrics [7,12]. Comparable baseline profiles have also been emphasized as essential for reliable assessment of recovery outcomes in ERAS research [11].Postoperative pain scores were significantly lower in the ERAS group at both 12 and 24 hours following surgery. This reduction can be attributed to the use of multimodal analgesia, regional anesthesia techniques, and early mobilization, which together reduce opioid requirements and improve maternal comfort. Similar improvements in postoperative pain control have been reported in prospective randomized trials and comparative studies evaluating ERAS pathways in caesarean delivery [7,9]. These findings underscore the role of standardized analgesic strategies in optimizing early postoperative recovery.Early achievement of recovery milestones was a key finding in the present study. Women managed under the ERAS protocol ambulated earlier, resumed oral intake sooner, had earlier catheter removal, and were discharged earlier compared to those receiving standard care. Reduced length of hospital stay is a well-recognized indicator of ERAS effectiveness and has been consistently reported in both obstetric and non-obstetric surgical populations [8,10,12]. Shorter hospitalization not only reflects improved physiological recovery but also contributes to reduced healthcare costs and better resource utilization.The incidence of postoperative complications was markedly lower in the ERAS group. Complications such as hypotension, postoperative nausea and vomiting, wound infection, and urinary retention were either absent or minimal, whereas they were more frequent in the standard care group. These findings are consistent with earlier reports demonstrating lower morbidity rates with ERAS implementation following caesarean section [7,11]. Optimized perioperative fluid management, maintenance of normothermia, early mobilization, and avoidance of prolonged catheterization likely contributed to the observed reduction in complications.Despite its strengths, the study has certain limitations. The relatively small sample size and single-center design may limit generalizability. In addition, neonatal outcomes and patient-reported satisfaction measures were not evaluated. Future multicentric studies with larger sample sizes and comprehensive outcome assessment are warranted to further validate the benefits of ERAS in caesarean delivery and support its widespread adoption in routine obstetric practice [11,12].

CONCLUSION

The findings of this prospective comparative study demonstrate that implementation of the Enhanced Recovery After Surgery (ERAS) protocol in elective caesarean section is both feasible and beneficial in a tertiary care setting. Women managed with ERAS experienced significantly better postoperative pain control, earlier mobilization, faster initiation of oral feeding, and shorter hospital stay compared to those receiving standard perioperative care. In addition, the ERAS protocol was associated with a marked reduction in postoperative complications, indicating improved maternal safety. Adoption of ERAS pathways in routine obstetric practice can enhance postoperative recovery,

optimize resource utilization, and improve overall quality of care for women undergoing caesarean delivery.

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