

<https://doi.org/10.48047/AFJBS.6.15.2024.9334-9346>



African Journal of Biological Sciences

Journal homepage: <http://www.afjbs.com>



Research Paper

Open Access

STUDY OF IMPLEMENTATION OF ERAS GUIDELINES IN ELECTIVE CAESAREAN SECTION

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Volume 6, Issue 15, Sep 2024

Received: 15 July 2024

Accepted: 25 Aug 2024

Published: 05 Sep 2024

doi: [10.48047/AFJBS.6.15.2024.9334-9346](https://doi.org/10.48047/AFJBS.6.15.2024.9334-9346)

Abstract:

There is an increasing body of evidence to support the advantages of Enhanced Recovery After Surgery (ERAS) in improving the outcome of a wide range of surgical procedures. However, there has been insignificant formalised application of ERAS principles in obstetrical surgery. In view of this, we decided to conduct a study on implementation of ERAS guidelines in caesarean sections. 55 patients reporting for delivery to a tertiary care hospital affiliated to a teaching hospital were selected by purposeful sampling based on specific inclusion and exclusion criteria and who underwent planned caesarean section. The aim was to assess the response of patients to the specific pre-, intra and postoperative care as recommended in the ERAS protocol. The main interventions were continuing oral fluids till 2 hours before surgery and starting oral feeding, catheter removal and mobilisation within 6 hours of surgery without any untoward event. The patients were discharged on 3rd postoperative day. The postoperative outcome was highly satisfactory both from our and patient's point of view. It was felt that ERAS guidelines should be followed on a wider scale as a standard of care in caesarean sections.

Keywords: ERAS, caesarean delivery, Ambulation, Length of stay.

Introduction:

Significant changes have occurred in recent decades in the field of surgical technique. While no single approach has been shown to eliminate postoperative morbidity and mortality, it was felt that multimodal interventions [1] may lead to a major reduction in pre-, intra and post-operative morbidity. This thought process of promoting early recovery by minimising morbidity and ensuring smooth patient recuperation led to the formulation of ERAS (Enhanced Recovery After Surgery) guidelines.

ERAS guidelines were initially developed by Prof. Henrik Kehlet and Wilmore, Denmark in the year 1993 to improve patient outcomes after colorectal surgery [2]. ERAS works by controlling specific aspects of perioperative care. This concept has been extended and developed for various surgeries such as biliary-pancreatic surgery, gastric resection, and pelvic surgery including onco-gynaecology.

ERAS for obstetrics with a changed nomenclature Enhanced Recovery After Caesarean (ERAC) was introduced in August 2012 by Lucas and Gough [3]. Obstetric patients, dealing with the combined challenges of being postpartum and postoperative, could significantly benefit from protocols aimed at optimizing their recovery to normal physiological function, thereby potentially reducing surgical complications [6]. The protocol involves a multidisciplinary team effort of the anaesthesiologist, obstetrician, nurse, hospital staff, and the patient herself. The primary goal of the ERAC pathway was to blunt the response to surgical stress through the optimization of patient care. Subsequently, R. Douglas Wilson, Aaron B. Caughey et al provided evidence-based guidelines for caesarean section in 2018 [4-6].

Caesarean delivery (CD) is a common surgery in India, with a 21.5% caesarean rate which has doubled since 2006 [7]. The global burden of obstetrical surgery includes approximately 140,000,000 births annually with an estimated 23% caesarean rate [7]. Most women who undergo caesarean delivery are typically young and in good health, which enables them to potentially recover quickly after caesarean delivery. Moreover, their eagerness to care for their newborn immediately after delivery drives them to regain normal physiological function as quickly as they can. With this background, we decided to conduct a study to assess the response of patients undergoing planned caesarean delivery to the ERAS protocol and explore its feasibility of being introduced as a routine practice.

Methodology:

This prospective interventional study was carried out over 2 years in 55 patients who were admitted to Dr D Y Patil Medical College, Hospital and Research Centre, Pune. They were selected by purposeful sampling and those scheduled to undergo elective caesarean section were included in the study. Cases with medical conditions like uncontrolled diabetes, cardiac disease, surgical or obstetric comorbidities in the form of antepartum haemorrhage or evidence of chorioamnionitis and intraoperative complications were excluded.

A written informed consent was obtained, and those consenting and satisfying the inclusion/exclusion criteria were finally recruited for the study. The sample size was calculated with the help of Winpepi software. Ethical approval was secured from the institutional Ethics and Scientific Committee under clearance number IESC/PGS/2022/12.

The interventions recommended in the ERAS guidelines for different perioperative stages were implemented as follows:

Preoperative interventions:

- Counselling the patient about the entire process.
- Pre-operative nutrition protocol- Restriction of solid food from 6 hours before surgery; carbonated glucose drink (Appy fizz) 100ml/hour given up to 2 hours before surgery.
- A single dose of intravenous Paracetamol as perioperative analgesia and 1000ml Ringer Lactate solution were given for pre-loading.
- Injection of metoclopramide 10 mg to reduce intra and postoperative nausea and vomiting
- Skin preparation with chlorhexidine alcohol and prophylactic antibiotic of single dose Cefotaxime 1gm as per protocol.
- Vaginal preparation with povidone-iodine solution.

Intraoperative interventions:

- Delayed cord clamping, active management of 3rd stage, initiation of breastfeeding as soon as possible.

Postoperative interventions:

- Oral feeding with sips of water started within 2 hours of surgery and solid food 6 hours after surgery.
- Mobilisation and removal of the urinary catheter 6 hours after surgery.
- Post-operative analgesia: injection of Paracetamol 1gm 8 hourly on the day of surgery and on POD1 (Post-operative day) and thereafter as and when required basis from POD2.

Postoperative monitoring:

- Postoperative pain scoring was done on the day of surgery, POD1 and POD2 using a Visual analogue scale (VAS) scoring system
- Length of time between surgery and ambulation
- Time of first oral intake of clear liquids.
- Time interval between Foley's catheter removal and free passage of urine.
- Monitoring temperature, pulse, respiratory rate and blood pressure as per protocol.
- Postoperative Nausea and Vomiting
- The first recording of peristaltic sound.
- Time of passage of flatus.
- Time of passage of stool.
- Length of stay in hospital.
- All patients were discharged on POD3. Criteria for discharge were as follows:
 - a. Adequate oral intake
 - b. Good pain control with oral analgesics, if required.
 - c. Adequate mobilisation.
 - d. Normal vital parameters.
 - e. No evidence of surgical site infection.
 - f. Normal bladder and bowel function.
- Patient satisfaction feedback was taken at the time of discharge on a 5-point Likert scale.
- Readmissions to the hospital.

Results were tabulated and analysed.

Observation and Results:

The mean age of our patients was 27.15 ± 4.26 years. Majority of them were term (37-40 weeks) pregnancies, 89% of patients were multigravida and the indication in them was repeat caesarean section. All cases were done under spinal anesthesia. None of the patients had febrile morbidity ($>100.4^0$) or significant nausea and vomiting.

Table 1: Assessment of pain by VAS score

Day of surgery	SCORE	No. of patients	Percentage
	4	6	10.90%
	5	26	47.27%
	6	10	18.18%
	7	13	23.63%

POD 1	SCORE	No. of patients	Percentage
	3	8	14.54%
	4	40	72.72%
	5	7	12.72%

POD2	SCORE	No. of patients	Percentage
	3	6	10.90%
	4	49	89.09%

The VAS score on the day of surgery was between 4-7, on POD1 it was between 3-5. On POD2 pain score varied between 3 to 4.

Table 2: Post-operative requirement of analgesics

Post-Operative Analgesics required (doses)	No. of patients	Percentage
On day of surgery		
3	47	85.45%
4*	8	14.54%
On POD1		
3	40	72.72%
4*	15	27.27%
On POD2 (as and on required basis)		
Not required	6	10.90%
Single dose	49	89.09%

*those patients who required an additional dose of analgesic over and above the scheduled 3. On POD0 and POD1 14.54% and 27.27% of patients required additional doses. On POD2 89.09% of patients were managed with a single dose of analgesic.

Table 3: Time Interval Between Surgery and First Ambulation

Time interval (hours)	No. of patients	Percentage
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6	51	92.7%
7	2	3.6%
8	2	3.6%

As per guidelines, all patients were mobilised by 6 hours. In case of 4 patients, mobilisation was delayed by 1-2 hours because they perceived more pain.

Table 4: The time interval between catheter removal and the free passage of urine.

Time interval (in min)	No. of patients	Percentage
30	18	32.7%
40	1	1.8%
45	14	25.5%
60	22	40.0%

The catheter was removed from all patients by 6 hours and they passed urine freely within 1 hour. None required re-catheterisation.

Table 5: Time Interval Between Surgery And Bowel Movement

Time of evidence of bowel movement (in hrs)	No. of patients	Percentage
6 to 10	27	49.09%
10 to 14	18	32.72%
14 and above	10	18.18%

For bowel movement, we considered peristaltic sounds on auscultation or passage of flatus or passage of stools.

TABLE 6: Assessment of patients satisfaction:

Assessment of patient satisfaction	No. of patients	Percentage
Highly satisfied	40	72.72%
Satisfied	10	18.18%
Neither satisfied or dissatisfied	5	9.09%
Dissatisfied	0	0%

Highly dissatisfied	0	0%
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72.72% of patients were categorised as Highly satisfied.

Among the 55 patients included in this study, only one was readmitted for secondary suturing for superficial SSI of the skin incision site.

Length of stay:

All patients included in the study were discharged on POD3. Before discharging patients were confirmed to have met the discharge criteria mentioned in the methodology. After discharge patients were followed up on the telephone periodically.

Discussion:

Although the concept of ERAS was postulated in the 1990s as a definitive step towards improving perioperative care, its acceptance for Caesarean deliveries has been limited. The mechanism underlying its efficacy has been explained by various authors. O Ljungqvist in his review on Insulin Resistance and Enhanced Recovery After Surgery stated that the body enters a catabolic state during any surgery due to the release of stress hormones and inflammatory mediators, which induce insulin resistance [8]. The extent of resistance is directly proportional to the complexity of the surgical procedure, thus increasing the morbidity and prolonging recovery. Hyperglycaemia directly correlates with muscle mass reduction, contributing to infections, adverse cardiovascular events, and impaired mobilization [9]. Implementing ERAS care elements aim to reduce surgical stress and maintain euglycemia, thereby mitigating morbidity. Patient education counselling and decision-making are required to reduce anxiety and fear, thereby facilitating successful implementation of an ERAS program.

In the current study, the majority of patients undergoing caesarean section were between 18 to 35 years. Women who undergo caesarean delivery are generally young and in good health. They often aim to recover quickly, resume normal activities promptly, and begin caring for their newborns.

Traditionally, patients scheduled for elective surgery were required to fast overnight or for at least 8-12 hours before the procedure to reduce the risk of pulmonary aspiration.

Consuming high-calorie carbonated beverages up to two hours before surgery has been demonstrated to decrease preoperative feelings of thirst, hunger, and anxiety in patients

undergoing caesarean section. Reducing pre-operative fasting is also linked to decreased insulin resistance and a more favourable anabolic state after surgery. [10-12]

Post-operative nausea and vomiting (PONV) is indeed a common side effect after caesarean delivery, particularly when regional anaesthesia is used. Several factors contribute to the occurrence of nausea and vomiting like medications and maternal hypotension induced by regional anaesthesia. These symptoms also delay the initiation of early oral intake. Fluid pre-loading is effective in reducing hypotension and intraoperative nausea and vomiting. Patients included in the study were routinely preloaded with 2 units of crystalloid solution to prevent hypotension and injection of metoclopramide was given pre-operatively to reduce intra and post-operative nausea and vomiting.

A randomized control trial by Habib, Ashraf S. et al opined that metoclopramide with ondansetron reduced intraoperative nausea and vomiting and early postoperative nausea and vomiting compared with placebo [13]. Out of 55 patients in our study, 7.3% and 5.5% had one and two episodes of vomiting respectively. 87.2% of patients had no complaints.

Traditionally oral intake following surgery is postponed until the return of bowel sounds or the passage of flatus. Accordingly, oral feeding is often withheld for 8-12 hours after caesarean delivery. Thereafter patients are advised to take clear liquids followed by semi-solid food and finally a normal diet the next day. In the present study, we departed from the traditional approach. This early initiation of oral intake has been linked to facilitating early return of bowel function. Majority (49.09%) of our patients had an early return of bowel movement. Patients (81.8%) included in the study passed motion by POD1 evening and 18.2% of patients passed motion on POD2. None of the patients had any problem with constipation.

A randomised control trial by Rajlaxmi Mundhra et al reported initiation of sips of water within 2 hours of shifting out from OT and regular feeding within 8 hours of surgery in the ERAS arm. They found that these women had better recovery in terms of early resumption of normal diet compared to the conventional group (16.94 ± 5.86 vs 38.59 ± 12.5) [14].

In earlier times, per-operative bladder drainage during caesarean section was maintained with a simple rubber urethral catheter, which was removed immediately after surgery on the OT

table. Subsequently continuous drainage with Foley's catheter became the norm with catheter removal on postoperative day morning. This was done more for convenience and logistics rather than any scientific evidence.

In this study, catheter removal was done 6 hours after surgery without any voiding problem. The early removal of catheters not only facilitates patient mobilization but also serves to reduce the risk of urinary tract infections and minimizes discomfort associated with prolonged catheterization.

A comparative study done by Janu Kanthi Mangala, Chithra Remadevi et al mentioned removing Foley's catheter 12-hours after surgery and no complications were reported [15].

In our institution, we typically mobilize patients 12 hours post-surgery. Early mobilization has several positive effects. It improves pulmonary function and tissue oxygenation, facilitates early return of bowel function, keeps insulin resistance down, reduces the risk of thromboembolism, and also shortens the length of hospital stay. None of our cases had post-spinal headaches. Tshering Tamang et al in their study on caesarean section, mobilised patients routinely after 6 hours. They concluded that early oral intake, ambulation, and early catheter removal in the postoperative period might have played an important role in the faster recovery of patients [16].

Pain is the most distressing factor following any surgical procedure. It may predispose to various adverse effects that can lead to multiorgan dysfunction. It activates the hypothalamic-pituitary-adrenal (HPA) axis, resulting in increased cortisol production, which can cause anxiety, insomnia, and disorientation. HPA axis activation also enhances sympathetic stimulation and raises levels of antidiuretic hormone (ADH), aldosterone, catecholamines, angiotensin, and prostaglandins in the body. These physiological changes can reduce urine output and necessitate prolonged catheterization. Hence effective post-operative analgesia is mandatory for satisfactory recovery after surgery.

Providing effective post-operative multimodal analgesia is a crucial component of the ERAS protocol. Previously, opioids were the standard post-operative analgesic. Avoiding opioids is recommended due to their potential side effects on the gastrointestinal (GI) system. These effects can delay recovery and increase discomfort for patients undergoing surgery, including caesarean sections. Therefore, utilizing alternative pain management strategies that reduce

reliance on opioids is beneficial in enhancing recovery and minimizing these adverse GI effects. [17]

Inadequate pain relief is linked to slower functional recovery and delayed mobilization, potentially increasing the likelihood of thromboembolic complications. It may also hinder maternal bonding with the newborn, contribute to breastfeeding challenges, and elevate the risk of persistent pain and postpartum depression. Paracetamol analgesia in our study was effective and all the patients had good post-operative recovery.

Caesarean delivery like any other surgery, increases the risk of infection and its related morbidity 5 to 20-fold compared to vaginal delivery. Infections increase maternal morbidity as well as longer stays in hospitals. Prophylactic antibiotics for 3-5 days were being followed by surgeons till the recent guideline of perioperative single-dose antibiotics became the norm. In caesarean deliveries as per a recommendation in the past, antibiotics were withheld until cord clamping to reduce neonatal exposure to antibiotics. Patients included in this study all received a single dose of cefotaxime 30 minutes before skin incision. Except for one case of SSI, there were no other post-partum infections.

Besides antibiotics, more important preventive measures for SSI are proper haemostasis, good operative technique and diligent skin preparation. The percentage of SSI reported in the literature is around 1.6-38 % and is mainly due to a lack of proper skin preparation [18,19] Such infections lengthen the stay in the hospital which affects mental health. In the study, out of 55 patients, 98.2% had no surgical site infection. A single case of superficial surgical site infection was observed when the patient came back for complete suture removal, for which the patient required a readmission which was managed conservatively by daily dressing followed by secondary suturing, culture report was suggestive of no growth of any organism.

Most patients undergoing caesarean section in our institute are discharged after suture removal on the 7th postoperative day. The study participants were discharged on the 3rd postoperative day after fulfilling the discharge criteria.

A study done by D. Adshead et al In the UK, concluded approximately 40% of women go home the day after their planned Caesarean section after the implementation of the ERAS pathway [20].

A study by A.M. Kleiman et al in the UK included 357 patients showed Implementation of ERAS resulted in a shorter length of stay (2.5 ± 0.6 vs 2.9 ± 1.1 days, $P < 0.001$; Fig. 3). [21]. The majority of women expressed satisfaction with the entire process of ERAS. Patients while expressing satisfaction specifically highlighted the personal care, early oral feeding and early discharge.

Conclusion:

The enhanced recovery after surgery protocol is a multimodal approach to perioperative care which was implemented in colorectal surgery. The aim was to improve the overall outcome of postoperative recovery from the objective viewpoint of the surgeon and the subjective of the patient.

The overall result has been satisfactory, particularly the interventions like the preoperative feeding schedule, early post-operative catheter removal and mobilisation, early commencement of oral feeding after surgery and all these measures making early discharge from the hospital on POD 3 feasible. The complications have been negligible. The feedback from the participants was also encouraging. The adaptation of ERAS in practice requires a potential shift towards optimizing perioperative care by promoting the laid down guidelines. Based on the positive feedback and perceived benefits from patients, applying ERAS guidelines to Caesarean sections on a wider scale appears to be the standard of care.

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