EAS Journal of Anaesthesiology and Critical Care
Abbreviated Key Title: EAS J Anesthesiol Crit Care
ISSN: 2663-094X (Print) & ISSN: 2663-676X (Online)
Published By East African Scholars Publisher, Kenya

OPEN ACCESS

Volume-8 | Issue-1 | Jan-Feb-2026 | DOI: https://doi.org/10.36349/easjacc.2026.v08i01.002

Original Research Article

Evaluation of the Protocol for Enhanced Recovery after Cesarean (ERAC) Delivery in Sub-Saharan Africa

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Article History
Received: 11.11.2025
Accepted: 16.01.2026
Published: 22.01.2026

Journal homepage:
https://www.easpublisher.com

Quick Response Code

Abstract: ***Introduction***: Enhanced recovery after cesarean (ERAC) delivery is a multimodal approach aimed at reducing surgical stress and accelerating maternal recovery after cesarean. Its application remains limited in many African contexts. This study evaluated the application and results of an ERAC protocol in an hospital of sub-Saharan Africa. ***Patients and Methods***: this is a prospective, descriptive and analytical study conducted over 5 months. Fifty patients who underwent a caesarean section under spinal anesthesia and met the inclusion criteria were analyzed. The data was collected from obstetric records, anesthesia registers and interviews with patients. The variables included demographic, per and postoperative clinical parameters as well as maternal feeling and satisfaction. The analyses were performed with STATA with a significance threshold $p<0.05$. ***Results***: The average age of patients was 27.2 years. The majority of caesarean sections were scheduled (82%) and performed for scarring of the uterus (44%) or fetal and adnexal pathologies (30%). All patients benefited from effective multimodal analgesia, an early mobilization and feeding protocol. Immediate skin-to-skin contact was established in 96% of patients. Postoperative pain was well controlled with a VAS < 3 at rest in 84% of patients. Overall maternal satisfaction was high in 92% of parturients. The most common adverse events were postoperative nausea vomiting (34.6%) but did not compromise the benefits of the protocol. The average length of stay was 57 hours. ***Conclusion***: The implementation of the ERAC protocol in sub-Saharan Africa is feasible and well accepted by patients. It promotes rapid recovery, pain control and strong maternal satisfaction. Enhanced staff training could optimize the application of the protocol.

Keywords: ERAC, Caesarean, Anesthesia, Sub-Saharan Africa.

INTRODUCTION

Cesarean is a frequent surgical procedure. Classic postoperative practices can delay maternal recovery and extend the duration of hospitalization. Enhanced recovery after cesarean (ERAC) delivery is a multimodal approach aimed at reducing surgical stress and accelerating functional recovery. Adapted for cesarean section, it is based on the patient's information, effective multimodal analgesia, prevention of complications, mobilization and early feeding as well as strengthening the mother-child bond [1]. Despite its proven benefits, the implementation of the ERAC remains limited in many African contexts. This study aims to evaluate the application and results of a ERAC protocol after caesarean section in an hospital of Ziguinchor, southern Senegal.

PATIENTS AND METHODS

We conducted a prospective, descriptive and analytical study covering a period of 5 months from July to November 2025. The study population consisted of all the parturients who were operated on in our facility for a caesarean section during the study period. We included patients who underwent the procedure under spinal anaesthesia and met the following criteria: a gestational age greater than 30 weeks of amenorrhea, an ASA class ≤ 2. A data collection sheet was designed with the KoboToolbox platform. The data were collected from an individual interview with each patient, obstetric records,

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anesthesia record, operating report and practice observation. Free and informed verbal consent was obtained from all participants in the study respecting confidentiality and anonymity. Qualitative variables included:

- The profession, the surgical indication, the ASA class, the Dupuis color code, the type of anesthesia, the anesthetic drugs, the type of incision;
- Peri-operative analgesia,
- The prevention of post-operative nausea and vomiting, thrombosis, infection, bleeding;
- The occurrence of adverse events and immediate postoperative incidents;
- The patient's future, her level of satisfaction, her maternal mood, as well as her feelings during the first contact with the newborn and her opinion on breastfeeding.

Quantitative variables included:

- Age, weight, height, body mass index (BMI), pregnancy term, durations of the procedure and anesthesia, Apgar score, VAS (visual analogic scale)
- The delay in removing the urinary catheter, stopping the infusions, resuming feeding (liquid, semi-liquid and solid)
- The delays for resuming transit (gas and saddle), using an intravenous painkiller, and the duration of the stay.

Quantitative variables were described by mean and standard deviation or by median and extreme values. The qualitative variables were described in numbers and percentages. The univariate and bivariate analyses were carried out with the STATA software. Chi-square test (χ 2) was used to study the association between two qualitative variables. The threshold of significance was set at $p < 0.05$.

RESULTS

During our study period, 350 cesarean sections were performed in the department. Among the caesarean patients, fifty (50) were included in our analysis corresponding to those who benefited from ERAC program. The average age was 27.2 years with extremes of 14 and 41 years. The age group from 25 to 29 years was the most represented with 32% of the workforce. Housewives were the most represented, at 34%. Patients from neighboring towns in Ziguinchor accounted for 48% of the workforce. We found 6% of diabetics, 4% of hypertensives and as many sickle cell disease and asthma. The patients operated on in the set program were more numerous, namely 82%. The most frequent diagnoses were pregnancies with a scarred uterus (44%) followed by fetal and adnexal pathologies (30%). The majority of patients (88%) had a diagnosis classified as Dupuis color code green. A small part was classified as code orange, that is 12%. Pregnancy was full term in 96% of the parturients. Class ASA 1 was found in 78% of the sample and class ASA 2 in 22%. All patients were informed about the objectives and benefits of the ERAC. The majority (82%) arrived at the hospital on the day of the cesarean section. A classic pre-operative soap shower was done in 70% of the patients. The rules of pre-operative fasting were observed at 96% for liquids and 88% for solids. The majority of patients (88%) had walked to the operating room. During the intraoperative phase, all patients underwent spinal anaesthesia with a 25-gauge puncture needle. The puncture at the L4-L5 space was the most frequent (72%) followed by the L5-S1 space (18%). A mixture of 7.5mg of hyperbaric bupivacaine + 100µg of morphine + 25µg of fentanyl was administered to all patients. Antibiotics were systematically administered before umbilical cord clamping. The most commonly used antibiotic was Cefuroxime (56%). Amoxicillin was used in 44% of patients. Warming of the patient and vascular filling fluids was done in 86% of women. The vascular filling was systematically less than 1000ml of crystalloids. Tranexamic acid was administered in more than half of the patients, 62% of cases. The technique of Joël Cohen was widely favored, representing 78% of the interventions. The prevention of postoperative nausea and vomiting was done in all patients. As part of this prevention, 62% of patients had received a combination of dexamethasone-ondansetron and 38% of dexamethasone alone. All patients received an oxytocin infusion and 74% had misoprostol. The early bond between mother and child was favored by immediate skin-to-skin contact in 96% of parturients. Apgar score was assessed in all newborns. The average duration of surgery was 38 minutes with extremes of 25 and 69 minutes. The average blood loss was 345ml [180-680]. Intraoperative hypotension occurred in 92% of patients and tachycardia in 8%. Blood loss increased with the duration of surgery with a statistically significant relationship ($p<0.005$). Postoperative analgesia was administered to all patients within the first hour. It systematically included paracetamol 1g and administration of nefopam 20 mg intravenously for all patients. A ketoprofen suppository 100 mg was administered in 98% of cases. The intensity of pain was assessed with the visual analog scale (VAS). Postoperatively, the resting VAS was less than 3 in 84% of patients with an average of 2.42. At mobilization, the VAS was less than 3 in 66% of parturients and greater than 7 in 8%. At postoperative H2, the indwelling urinary catheter was removed in 92% of patients and the peripheral venous line was blocked in 94%. Compared to the diet, 90% of the parturients took a drink at H2, 92% consumed a light soup at H4 and 100% freely fed at postoperative H8. At postoperative H6, as part of the prevention of thromboembolic venous disease, the first lift was respected in 90% of patients. Early breastfeeding was respected in 76% of parturients. For 60% of the patients, the first postoperative gas emission occurred between the 16th and the 32nd hour. The first saddle emission occurred between H33 and H48 in 56% of

parturients. The most notable postoperative incidents encountered were nausea and vomiting (34.6%), headache-neck pain (26.9%), pruritus (15.4%), bladder infection (7.7%) and arterial hypertension (7.7%). The evaluation of maternal comfort showed that sleep was of good quality in 88% of patients and easy movement in 90%. Feeding was easy in 86% of the patients and 90% were in a good mood. The duration of hospitalization was between 48 and 96H in 86% of patients with an average of 57 hours [40H - 96H]. Overall satisfaction was high. More than half (58%) of the patients declared themselves very satisfied at their release and 34% declared themselves satisfied. Postpartum mood was positive in 100% of the patients who declared themselves very satisfied. At the same time, all patients who reported low satisfaction had a negative mood ($p < 0.001$). There is therefore a very strong association between patient satisfaction and their postpartum mood. Post-operative adverse events were reported in 100% of patients with poor satisfaction, 64.7% of patients with high satisfaction and 37.9% of patients with high satisfaction but no statistically significant relationship ($p = 0.119$).

DISCUSSION

The implementation of ERAC in our study was confronted with several limitations that could influence the results. The main obstacles were sometimes insufficient communication within the care team leading to incomplete or inaccurate transmission of instructions. In addition, a large part of the staff had not received specific training on ERAC, which made it difficult to abandon well-established classical practices. Patient adherence has also been variable, particularly due to language barriers and sometimes, a limited understanding of the recommendations. These limits must be taken into account in the interpretation of the results. The average age of our patients was 27.2 years and extremes of 14 and 41 years. This result is similar to the results reported by Khanna and Guibla who also found an average age of 27.2 years in their studies [2, 3]. This age is indeed in the optimal fertility period of the woman, which is between 20 and 30 years old. In our series, the majority of cesarean sections were scheduled, or 82% of the total. This predominance of scheduled caesareans could be explained by our methodological choice to exclude patients whose pregnancy had not been properly followed. Studies have indeed shown that urgent cesarean sections are more frequent in patients whose prenatal follow-up is insufficient [5]. All our patients were classified as ASA2 due to a methodological choice. This is a choice in line with the recommendations of the ERAC protocol which primarily target low-risk patients in order to optimize postoperative recovery. Indeed, some pillars of ERAC such as early mobilization, rapid feeding, the limitation of opioids can be incompatible in patients classified as ASA3. The most common diagnosis in our series was scarred uterus with a frequency of 44%. This is indeed a frequent indication of a planned caesarean section due to the risk of uterine rupture, especially in contexts where the conditions for labor monitoring are limited [6]. In our series, all patients have been informed about ERAC. This is an important step because information is a pillar of the ERAS allowing to make the patient an actor in their care. It reduces pre-operative anxiety, and ensures better adherence to post-operative recommendations. The majority of patients (82%) arrived on the day of the intervention. This approach, often called optimized ambulatory admission, tends to reduce the duration of hospital stay. Patients are hospitalized the day before the intervention only in case of medical necessity. Preoperative fasting recommendations regarding clear fluids were followed by 95% of patients. The rules for solid food were followed by 88% of parturients. Preoperative fasting remains necessary for pregnant women even if they are considered to have a full stomach from the 20e WA [7]. Indeed, even if parturients are considered as 'full stomach', preoperative fasting reduces the volume and density of gastric content as well as the risk of inhalation. However, as part of a ERAC protocol, prolonged fasting is avoided. Clear liquids are pursued up to two hours before the intervention. Solid food is now up to six hours before the intervention [8]. The goal of this approach is to preserve the patient's hydration, comfort, and energy. The preoperative shower was taken in only 70% of patients. This shower is generally carried out on the morning of the intervention with a mild antiseptic soap, avoiding irritants or perfumed products [9]. This shower reduces the risk of postoperative infections. The rate of application of intraoperative warming of the patient as well as that of the solutes was 86%. In practice, these measures consisted of systematically covering the patients' chest during the intervention and warming the crystalloids to 37°C. These measures improve patient comfort by reducing the incidence of chills and the feeling of cold. It also reduces the risk of hypothermia, which can cause platelet dysfunction and bleeding. Prevention of postoperative nausea and vomiting was done in all patients. Two drugs were used for this purpose: dexamethasone and ondansetron. Dexamethasone was administered to all patients. It was associated with ondansetron in 62%. These drugs have synergistic mechanisms of action. Dexamethasone acts at the level of the brainstem, particularly at the level of the initiating chemo-receptor area (area postrema). It modulates the release of serotonin, dopamine, and substance P which are involved in vomiting. Dexamethasone also improves gastric emptying [12]. The ondansetron, for its part, acts by blocking central and peripheral 5-HT3 receptors [13]. Antibiotic prophylaxis carried out in all patients aims to reduce the risk of post-operative infection. Cefuroxime was used in 56% of patients and amoxicillin in 44%. This antibioprophylaxis sometimes not in accordance with the recommendations is linked to cefuroxime ruptures. Oxytocin was systematically used. It was associated with misoprostol in 74% of patients. Carbetocin, administered as a single injection, is recognized for a longer duration of action (4 to 5 hours) and is better suited to the rapid rehabilitation

program [14, 15]. All patients underwent a spinal anaesthesia protocol with 7.5-8 mg + Fentanyl 25µg + Morphine 100 µg. The addition of intrathecal morphine blocks opioid receptors in the dorsal horn of the spinal cord. It thus confers prolonged central analgesia up to 24 hours post-operative [16]. This promotes early mobilization, a key criterion of ERAC protocols. In our study, the Joël-Cohen's technique was used in 78% of cases. This result is consistent with the literature which shows that this technique has several advantages compared to Pfannenstiel incision. Indeed, studies report that it generally allows a decrease in blood loss, a shorter operating time and an earlier resumption of feeding. It is also associated with a reduction in the need for anaesthetic reinfusions and less post-operative pain [17]. Skin-to-skin contact was immediately established in 96% of newborns, thus contributing to the strengthening of the mother-child bond. This contact also stimulates the secretion of oxytocin by the mother as well as the feeling of maternal satisfaction [18]. In our series, two newborns had an Apgar score below 7 requiring immediate neonatal resuscitation which prevented early skin-to-skin contact. The resumption of the post-operative H2 drink was compliant in 90% of our patients. The objectives of this early resumption of feeding are to reduce post-operative ileus, accelerate the resumption of transit, and improve patient comfort and satisfaction [19]. In our series, at H2 post-operative, the bladder catheter was removed in 92% of patients and the venous ducts were blocked in 94%. The objective of this attitude is to promote early mobilization and autonomy for patients while reducing the risk of infection. At postoperative H6, the majority of patients (90%) had resumed ambulation. It is a mandatory step in a ERAC protocol to reduce the thromboembolic risk, respiratory complications, accelerate the resumption of intestinal transit and reduce the duration of hospitalization [11]. The principle of multimodal analgesia in post-caesarean pain management was applied to all patients. The intrathecal injection of bupivacaine-fentanyl-morphine is known to offer effective and lasting analgesia [20]. This injection was systematically supplemented with analgesics of level I according to the recommendations of the WHO: paracetamol 1 g, nefopam 20 mg and ketoprofen 100 mg in suppository. One patient did not receive ketoprofen because she had a contraindication. This protocol allowed satisfactory control of the pain which was assessed every six hours by the VAS. We found a static VAS ≤ 3 in 84% of the patients and a dynamic VAS ≤ 3 in 66%. Despite preventive measures, post-operative nausea and vomiting were found in 34.6% of patients. They are frequent after a cesarean section, especially under spinal anesthesia [21]. Management was based on the administration of ondansetron 4 mg sublingually at each episode of vomiting. In our study, the majority of patients had a positive mood (90%), a result slightly lower than that reported by Maiga (92.1%) [22], but remaining globally comparable. A positive feeling regarding contact with the newborn was found in 96% of patients our series; a rate close to the 98.7% reported by Maiga [22]. This result testifies to the favorable impact of optimized rehabilitation practices on the quality of the mother-child bond in post-operative care. The majority of patients (92%) were satisfied. The dissatisfaction expressed by some patients was mainly related to the conditions of stay deemed insufficient. The analysis of the association between patient satisfaction and post-operative complications does not highlight a statistically significant link (p = 0.119).

CONCLUSION

The implementation of the enhanced recovery after cesarean (ERAC) delivery protocol in our context has shown that this approach is feasible and well accepted by patients. Our results show that ERAC allows a rapid recovery characterized by an early resumption of feeding, mobilization and effective pain control. Immediate skin-to-skin contact and the active involvement of patients have favored maternal satisfaction. The adverse events, although present, did not compromise the benefits of the protocol. However, efforts to strengthen staff training are necessary to ensure better application of the protocol.

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Cite this article: Barboza D, Kane MM, Ellouxe AK, Ntab SO, Sambou P (2026). Evaluation of the Protocol for Enhanced Recovery after Cesarean (ERAC) Delivery in Sub-Saharan Africa. *EAS J Anesthesiol Crit Care, 8*(1), 7-11.