

CASE REPORT

Implementation of Enhanced Recovery After Caesarean Section (ERACS) in Elective Procedure : A Case Report

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ABSTRACT

Background: Enhanced Recovery After Cesarean Section (ERACS) protocol includes every component of the pre-operative, intra-operative and post-operative pathway. In the pre-operative phase, the protocol applied to this patient included the shortest possible fasting interval, oral intake of liquid carbohydrate and patient counselling. For intra-operative pathway, the components applied are prevention of hypotension, maintenance of normothermia, optimal uterotonic administration, IONV (intra-operative nausea and vomiting)/PONV (post-operative nausea and vomiting) prophylaxis, multi-modal analgesia and optimization of fluid administration. Post-operatively, the patient was given early nutritional intake, early mobilization, urinary catheter removal, venous thrombo-embolism prophylaxis, multi-modal analgesia and glycemic control. ERACS prove useful for early discharge, improving outcomes such as breastfeeding or reducing post-discharge opioid use.

Case Illustration: A 31-year-old woman came with the chief complaint of fluid discharge since \pm 3 hours prior to admission to the hospital. Based on the medical history, physical examination, and laboratory findings, the patient was diagnosed with premature rupture of membranes in a gestational age of 37-38 weeks and had a live, single-headed presentation of the fetus. Patient's physical status is ASA II and scheduled for elective C-section procedure with spinal anesthesia.

Conclusion: The implementation of the ERACS protocol in this case has been shown to reduce the rate of infection and post operative complications as well as reducing length of stay for the mother.

Keywords: ERACS; ERAS; sectio caesaria; spinal anesthesia

INTRODUCTION

Enhanced recovery after surgery or ERAS is a multi-disciplinary perioperative care protocol standard in surgical patients that aims to prevent stress and attempt to modify the stress response resulting in better outcomes¹. Differ from current conventional perioperative care, ERAS emphasizes a process consisting of a variety of interventions that may reduce surgical stress, maintain balance physiological function, and speed up the recovery process to its previous state¹. In the UK, approximately 40% of women go home the day after their planned Caesarean section with many being enrolled on ERACS pathways².

The Enhanced Recovery After Surgery (ERAS) protocol was developed in 2001 by a group of surgeons in Europe. The protocol was pioneered by Henrik Kehlet with the objective to improve post-operative clinical outcomes. ERAS protocols were originally developed for colorectal surgery, but over time, the ERAS protocol was developed for many other surgical subspecialties. To date, ERAS Society has published various guidelines and recommendations including for colorectal (2005), gastrointestinal (2012), gynecologic oncology (2016),

bariatrics (2016), hepatology (2016), head and neck cancer (2017), breast reconstruction (2017) to section cesarian (SC) procedure^{3,4}.

ERAS guidelines on cesarean delivery or Enhanced Recovery After Cesarean Section (ERACS) were introduced in 2018, long after recommendations on other subspecialties were published. Thus, the ERACS protocol is still very limited, and more studies are required following the different circumstances of the patient⁴. Most of SC patients are healthy patients without severe comorbid, so the probability of successful ERAS is greater than in other surgeries where the patient's condition already has a severe comorbid. The ERACS protocol on cesarean delivery aims to improve the quality and safety of cesarean delivery, maternal and fetal outcomes. Immediate post-operative recovery as early as possible will enable a newly mother take care of her baby more quickly⁵.

Several studies have been conducted on patients indicating cesarean delivery procedures with the ERACS protocol showed a good prognosis in the short and long term. Based on Liang Li in 2017, patients with 80-100% ERAS compliance had a 6.9% risk of infection and 16.7% in

complications, compared to patients with 0-60% ERAS compliance who had a 24.2% risk of infection of and 41.3% in complications. Another study revealed that 38.5% of women who had a C-section went home the next day. These findings suggest that ERAS protocol compliance had a role in the low incidence of secondary infections due to surgical procedure, lower post-operative complications rates and shorter hospitalization periods^{6,7}.

In low- and middle-income countries, including Indonesia, implementation of the ERACS protocol is still less than optimal. Though cesarean delivery rates continue to increase significantly from year to year. The results of Basic Health Research (RISKESDAS) 2018 showed the birth rate with caesarean delivery in Indonesia was 17.6% with the highest prevalence in DKI Jakarta at 31.1% and the lowest prevalence in Papua at 6.7%. In Aceh, the proportion of cesarean delivery is above the national average of 22%⁷.

The lack of optimal implementation of ERACS in Indonesia occurs due to lack of resources and costs needed⁵. Despite the obstacles, the ERACS protocol must still be implemented and prioritized. The

solution may lie in adjusting the ERACS protocol to better suit the conditions of poor and developing countries. This has been suggested by Nelson in 2021, who proposes focusing on the basic components of ERACS in advance (e.g., pre-operative optimization, multi-modal pain management, early post-operative mobilization) and assure to provide affordable drugs available to patients. Hospitals in developing countries may not able to adopt all ERACS recommendations at once, but rather start small and then establish their own protocols when improvements in clinical outcomes achieved and more resources are available^{8,9}.

This case report describes implementation of ERACS and its outcome in patient who underwent elective C-section procedure.

CASE ILLUSTRATION

A 31-year-old woman came to RSUD Zainoel Abidin Banda Aceh with the main complain of fluid discharge since \pm 3 hours before admitted to the hospital. There is no contraction or mucous discharge. The patient suggested that she is 9-months pregnant and had active fetal movement. The First Day of the Last Menstruation (*Hari Pertama Haid Terakhir*/HPHT) is on January 4th,

2021. Estimated of due date was October 11th, 2021. The estimated gestational age was 37-38 weeks. Routine antenatal care to obstetricians was 12 visits and to midwives was 2 visits. History of previous diseases and family history of asthma, heart disease, diabetes mellitus and hypertension were denied. The history of allergies was denied. The previous labor was 6 years ago, and this is the second pregnancy. Physical examination and laboratory results within normal limits.

Based on anamnesis, physical examination, and laboratory examination, concluded that the patient had an early rupture of membrane with gestational age of 37-38 weeks and single, alive, head-presentation fetus. Patient was ASA II physical status and had already scheduled for elective SC procedure with spinal anesthesia.

Pre-operative treatment consisted of 6-hours fasting prior to procedure (solid food), patient was allowed to drink sweet tea up to 2 hours before the delivery. Intra-operative treatment included ondansetron injection of 4 mg before spinal anesthesia was performed. Patient was arranged with spinal anesthesia in a sitting position, performed puncture on the intervertebral space L4-L5 using spinocain 27G. The

anesthetic regimen administered were bupivacaine 6.5 mg plus fentanyl 25 mcg and morphine 100 mcg, with a total volume of 1.9 cc diluted with cerebrospinal fluid (CSF) up to a total volume of 2.1 cc. The anesthesia regimen was injected at a speed of 0.4cc/second. Post-spinal anesthesia, patient was given oxygen via nasal cannula 3 l/m and administered 10 mg of ephedrine and 8 mg intravenous dexamethasone. The location of spinal anesthesia was obtained as high as T4. Aseptic and antiseptic precautions were performed, and draping was one to limit the area of surgery. Incision began 15 minutes after spinal anesthesia performed. The baby was safely born 15 minutes after the onset of incision and cried spontaneously. Umbilical cord clamping was delayed for 1 minute.

During the procedure, there were no hypotension and IONV (intra-operative nausea and vomiting). Patient was administered oxytocin 20 IU drip in 500 cc Ringer Lactate after the baby was born. Thirty minutes before the procedure was completed, the patient was given analgetic (paracetamol drip 1gr and ketorolac IV 30 mg). The procedure lasted for 1 hour and 45 minutes, with amount of intra-operative hemorrhage was 400 cc, urine output of

1.3 cc/kg/hour. During surgery the patient got 1000 ml of crystalloids.

After the procedure was completed, the patient then transferred to the PACU room and took into a warmer. The patient was then given sweet tea and biscuits and observed for 30 minutes. The patient was transferred to the inpatient room when achieved a bromage score of 0. (Figure 3) Analgesics (ketorolac 30 mg) continued for every 8 hours. The catheter removal was performed 6 hours post-spinal anesthesia. Within 24 hours, there was no sign of post-operative complications. Patients already mobilized and tried to independently take care for her newborn baby, then the patient was discharged with outpatient treatment education.

DISCUSSION

Enhanced Recovery After Caesarean Section (ERACS) is a multi-disciplinary, multi-modal perioperative management designed to decrease stress response during a section caesarean surgery, reduce complications, length of stay, and speed recovery time¹⁰.

Various studies in United Kingdom and other European countries has reported the advantages of ERACS, including improving the quality of services, and patient satisfaction that

able to immediately recovered as well as success in breast feeding and taking care the babies¹¹. The satisfaction rate of ERACS was very high compared to patients with routine care. The majority of mothers undergoing SC surgery are young and healthy patients, thus allowing for a rapid post-delivery recovery and return to regular activities¹². Comparative study conducted by Pravina in 2020 showed that SC groups implemented the ERAS protocol experienced faster early recovery time and higher satisfaction levels than the group with standard operative care. Therefore, this approach is expected to be applied to more pregnant women who will undergo SC procedure in the future¹³.

The implementation of ERACS requires the support of stakeholder and policy maker, due to its multi-disciplinary and multi-modality measures. The key to ERACS success depends on the collaboration of physicians, nurses, hospitals, and patients. Anesthesiologists are the center of this process and often take a leading role. The ERACS Society has published guidelines with evidence-level assessments and recommendation strength for each component of the pre-

operative, perioperative and post-operative pathways⁷. ERACS guidelines were created for both scheduled and unscheduled SC procedures. ERACS procedures range from 30-60 minutes before skin incisions to patient discharged¹³.

Pre-operative

Pre-operative treatments focused on 5 elements include shortest possible fasting-interval, administration of liquid carbohydrates, patient education, lactation/breastfeeding education and preparation, and hemoglobin optimization¹⁴. In this case, the patient was restricted from solid foods 6 hours prior the surgery and allowed to drink sweet tea for up to 2 hours pre-operative. The clinical consideration for this measure was because pregnancy will increase the risk of pulmonary aspiration from the stomach contents under anesthesia effect. Thus, pre-operative fasting has been recommended to limit this risk. As a result, pregnant women who undergo SC procedure will fast and starve for up to 20 hours until the actual surgery. It may increase catabolic markers and urinary ketosis. Therefore, a careful balance must be reached between these two conflicting directions, which is to ensure that the stomach is empty at the time of operation while preventing the

side effects of prolonged fasting. As a result, ERACS recommends the shortest possible fasting period and the use of liquid carbohydrate to minimize the effects of fasting¹⁵.

Solid food allowed up to 6-8 hours prior the surgery. Patients should be encouraged to consume non-particulate carbohydrate drink 2 hours before SC. Several studies showed that the drink may reduce the risk of aspiration, preventing hypovolemia, metabolic stress and ketosis when administered before a C-section^{7,15}. Furthermore, non-particulate carbohydrate drink is only given to non-diabetic women. The recommended amount is 45 grams of carbohydrates. For example, Gatorade 32 oz contains 54 grams of carbohydrates or apple juice contains 56 grams of carbohydrate. The prescription formulation of ERACS pre-operative high-carbohydrate beverages requires agreement with nutritionists at the hospital. In Indonesia patient may be given beverages such as tea, coffee without milk or pulp-free fruit juice up to 2 hours before the procedure^{7,15}.

Prior the surgery procedure, patients will undergo counselling session in accordance with ERACS protocol. Counselling and education are very important elements in the success of

ERACS implementation. The goal of ERACS counselling is to motivate and engage patients to better participate in treatment plans. It shall improve patient adherence during treatment, improve clinical outcomes and reduce patient anxiety. Ideally, this session is conducted one day before the day of procedure¹⁴.

The ERACS counselling includes the reasons/indications of cesarean delivery, the location and type of abdominal laparotomy incision as well as the techniques of abdominal skin incision closure will perform, preventive measures used to minimize the morbidity of post-operative maternal infections, the patient's estimated post-operative risk for thromboembolism and additional medical prophylaxis that may be

required, gastrointestinal intake plans during the period of time before and after surgery, as well as location and post-operative treatments on the mother and newborn baby¹³. The patient permitted to be transferred to the surgical preparation room prior to the SC procedure¹³.

Intra-operative

Intra-operative protocol carried out since the patient is in the operating room. Intra-operative protocols include preventing hypotension due to spinal anesthesia, maintaining normothermia, optimal uterotonic administration, antibiotic prophylaxis, IONV/PONV prophylaxis, multi-modal analgesia, breastfeeding support and maternal-infant bonding, optimization of fluid administration and delayed umbilical cord clamping¹⁴.

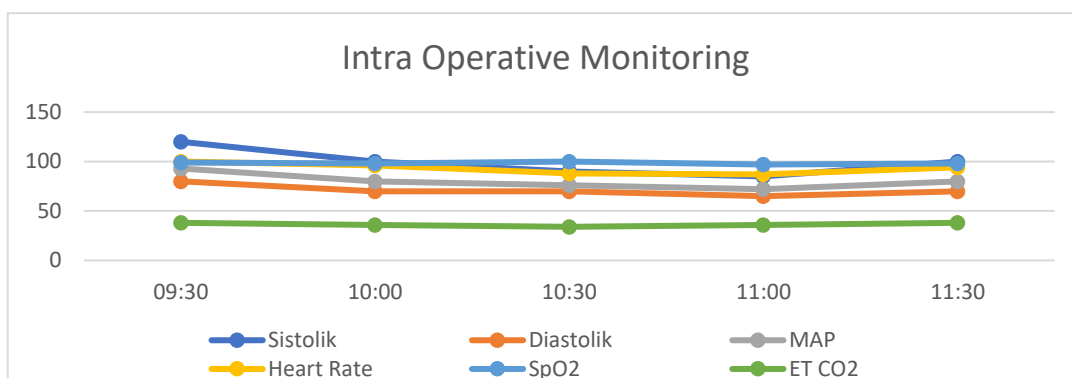


Figure 1. Intraoperative Vital Sign

In this patient, the anesthetic regimen was bupivacaine 6.5 mg plus fentanyl 25 mcg and morphine 100 mcg. Before spinal anesthesia, the patient was

administered 4 mg of ondansetron and post-spinal anesthesia, the patient accepted 10 mg ephedrine and 8 mg of dexamethasone intravenously. During

the surgery procedure, the patient was observed and no hypotension and IONV (*intraoperative nausea and vomiting*) were found.

Intra-operative nausea and vomiting (IONV) or post-operative nausea and vomiting (PONV) is common in women undergoing regional anesthesia during SC procedure and it has become an important clinical problem because this technique is widely used. A study showed the incidence of IONV and PONV accounted for 80% and 30% of all patients undergoing regional anesthesia during cesarean section, respectively. The underlying mechanisms of IONV and PONV in cesarean delivery mainly include hypotension due to sympathy colysis during neuraxial anesthesia, bradycardia due to increased vagal tone, and intravenous administration of opioids¹⁶.

Based on current guidelines and literature, the first step to reducing IONV and PONV incidence is comprehensive management of circulation parameters. This management includes the administration of perioperative fluids and the use of vasopressors in accordance with the necessary circumstances¹⁷. Hypotension due to spinal anesthesia in SC is not treated

with fluid, but with vasopressor. This is because the root cause of hypotension is vasodilatation, not due to hypovolemic state. Blood pressure is maintained according to the patient's daily baseline. The regimens includes phenylephrine, ephedrine or norepinephrine.^{16,18} Ephedrine is the first drug of choice to maintain maternal blood pressure. Its sympathomimetic stimulant activity on α - and β -adrenergic receptors causes positive inotropic and chronotropic effects. Norepinephrine may be used as an alternative vasopressor to stabilize the maternal blood pressure during spinal anesthesia at SC procedure without causing side effects to the neonatal outcomes¹⁸.

Furthermore, hypotensive prevention may achieved by use of low-dose local anesthesia, the addition of intra-theal opioids, the use of local solutions of hyperbaric anesthesia for adequate control of neuraxial distribution such as Bupivacaine 6.5mg, Fentanyl 25 mcg, and Morphine 100 mcg^{16,17}.

In addition, administration of antiemetic agent as a prophylaxis of IONV or PONV. Some of regimens may be used are 5HT3 antagonists (e.g. ondansetron 4 mg before spinal

anesthesia), D2 receptors antagonist (e.g. metoclopramide 10 mg before spinal anesthesia), or dexamethasone (after spinal anesthesia). A minimum of 2 modalities with different mechanisms for IONV and PONV prophylaxis are administered to the patient¹⁴.

During the delivery procedure, the maternal temperature should be monitored as well. Proper patient temperature monitoring is needed to consider the time to apply the warmer device and avoid hypothermia. Intra-operative hypothermia, defined as a condition when core body temperature of $<36^{\circ}\text{C}$. It might happen when patient loose high volume of blood during surgery. Maternal hypothermia might be a barrier to having skin-to-skin contact with the baby, as this will lead to neonatal hypothermia. Active warming has begun since the pre-operative protocol in the operating-preparation room in the form of in-line IV fluid warmer, forced air warming, and set the operating room temperature of 23°C during cesarean delivery^{5,7}.

After the baby is born, this patient is given an oxytocin drip 20 IU in 500 cc Ringer Lactate. The operation lasted for 1 hour 45 minutes and the intra-operative hemorrhage volume was

approximately 400 cc. Post-partum hemorrhage (PPH) is the leading cause of maternal death worldwide. The uterotonic drug is routinely recommended as a prophylaxis of PPH. Optimal uterotonic administration starts from the lowest dose in order to achieve sufficient uterine tone and minimal side effects. In elective SC, a bolus of oxytocin 1 IU is given and continued with oxytocin infusion dose according to clinical state of uterus. Excessive oxytocin will cause hypotension and nausea-vomiting¹⁴.

In this patient, analgetic given were paracetamol drip 1 gr and 30 mg ketorolac IV prior to the surgery. Multimodal analgesia that administered starting from durante surgery was neuraxial long-acting opioids such as intrathecal morphine 50-150 mcg (100 mcg) or epidural morphine 1-3 mg. If there is no contraindications, non-opioid analgesia such as paracetamol and NSAIDs IV may be given intraoperatively after the baby is born. The purpose of this administration is when the duration of the local drug anesthetic has been diminished, the drugs are already working, if neuraxial morphine is not given, consider local infiltration anesthesia on the incision

wound, such as *Transversus Abdominis* Plane (TAP) block, or *Quadratus Lumborum* (QL) block¹⁴.

Post-operative

Post-operative protocols include several elements, including nutrition intake, immediate mobilization, rest, urine catheter removal, venous thrombo-embolism prophylaxis, early discharge, anemia recovery, lactation consultation, multi-modal analgesia, glycemic control, and restoring gastrointestinal function¹⁴.

In this case, the patient was given sweet tea and biscuits and then observed for 30 minutes in the recovery room. Post-operative feeding in women who give birth by caesarean section has been reported to have quite an effect on the morbidity associated with cesarean delivery. Early intake after surgery suggests to reduce the risk of post-operative nausea and vomiting. Nausea and vomiting may increase the potential risk of aspiration, which becomes one of many causes of the maternal death. In addition, early intake after surgery can stimulate the restoration of gastrointestinal function, improve insulin sensitivity, reduce stress response due to surgery, reduce hospitalization



Figure 2. Patient was able to walk 6 hours post C-section procedure



Figure 3. Patient's Bromage score 0 after 30-minutes observation at PACU

length of stay and improve patient satisfaction¹⁶. ERACS recommends mothers to receive immediate oral intake, such as sweet tea and biscuits within 60 minutes of cesarean delivery.

Furthermore, regular diet allowed to be given 4 hours post-SC procedures¹⁴.

Furthermore, in less than 24 hours, patients recommended to mobilize. In this case, the patient may lift the leg within 2 hours after spinal anesthesia and walk to the bathroom without the help of 6 hours post spinal anesthesia. In line with general ERAS guidelines, it is recommended for early mobilization after surgery. SC causes post-operative changes in the autonomic nervous system, which lead to a decrease in bowel movements. Decreased motility might cause several problems including constipation, paralytic ileus, atelectasis, wound infections, urinary retention and urinary tract infections. Post SC patients need intensive supervision to reduce complications from surgery by early mobilization¹⁷.

Early mobilization theoretically expected to restore bowel function quickly, decrease the risk of thrombosis, and decrease the length of hospitalization. Spinal anesthesia for a C-section takes about 6 hours to disappear completely, but the range variation is wide. Therefore, it is important to ensure the absence of residual anesthesia before the first step of post-operative protocol^{7,18}.

Mobilization in the recovery room is carried out gradually after the administration of oral intake. If the patient feels comfortable, the bed allowed to be raised to 30 degrees. If there is no complaint, 10-15 minutes later the bed can be raised again. If there is no complaint, encourage the patient to sit without a backrest from the bed. If the patient is able and no complain, 15-30 minutes later encourage the patient to dangle his legs. Next, help the patient to stand up and walk¹⁴.

After 6 hours post-delivery, a urinary catheter in patient is removed. This is because patients didn't require a strict assessment of urine production. The timing of the catheter removal should also consider the absence of residual anesthesia. Urinary catheters are released to reduce the risk of urinary tract infections, urinary retention and reduce length of hospitalization^{16,18}.

Post-operative pain control needs to be performed carefully because it affects the length of recovery time. A high pain score will potentially prevent a mother's efforts to be independent and take care for her newborn. Multi-modal analgesia is a key in the management of post-operative pain as part of recovery protocols. Analgesia begins to be given

since intra-operative protocol. Avoid using opioids for post-operative analgesics unless the intrathecal route. Other analgesics are a combination of paracetamol and NSAIDs such as paracetamol 650 – 1000 mg per 6 hours and ibuprofen 600 mg per 6 hours (oral preparation). The post-operative combination of paracetamol and NSAIDs is highly recommended because it is effective, easy to administer, inexpensive, and opioid-efficient, causing fewer opioid-related side effects. NRS post operative this patient 3 and received ketorolac 30 mg per 8 hours intravenously on post-operative day (POD) 0 followed by oral paracetamol 1gr per 6 hours on POD 1.

CONCLUSION

ERACS protocol is a multi-disciplinary standardizes peri-operative care protocol in cesarean delivery patients to improve the quality and safety of sectio caesarean procedures to improve maternal and neonatal outcomes. ERACS implementation encompasses every component of the pre-operative, intra-operative and post-operative pathway. It has been shown to lower the rate of infections and post-operative complications as well as

results in shorter maternal length of hospitalization.

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