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Enhanced Recovery after Surgery versus Standard Care for Elective Cesarean Deliveries in the Tertiary Care Center, Rajavithi Hospital, Thailand

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ABSTRACT

Objectives: To compare the length of stay (LOS), pain score, opioid use, and complications of cesarean deliveries (CD) between an enhanced recovery after surgery (ERAS) and standard care protocol.

Materials and Methods: A total of 80 pregnant women with elective CD were enrolled in a prospective cohort study between January and May 2020. Forty patients were assigned to ERAS protocol, and the remaining 40 were determined under standard care. The ERAS protocol is composed of preoperative, intraoperative, and postoperative care. In addition, the ERAS was modified, including drinking water instead of carbohydrate because of serious aspiration concerns. The primary objective was the length of stay, and the secondary objectives were pain score, opioid use, and complications of CD.

Results: There was a significantly shorter LOS in patients under ERAS protocol (3.0 and 1.9 days, $p < 0.001$), reduced opioid use ($p < 0.001$), and pain score ($p < 0.001$) compared to standard care. Moreover, a shorter time to flatus was found (20 and 40 hours after CD). However, we found no difference in complications between the two groups.

Conclusion: ERAS protocol in elective CD was an effective method to reduce LOS, opioid use, pain score, and improve bowel function without significant complications.

Keywords: ERAS, standard care, elective cesarean delivery.

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การส่งเสริมการฟื้นตัวหลังผ่าตัดเปรียบเทียบกับการรักษาแบบมาตรฐานสำหรับการผ่าท้องทำคลอดแบบไม่ฉุกเฉินในศูนย์ตติภูมิ โรงพยาบาลราชวิถี ประเทศไทย

กมัยธร เทียนทอง, ธัญรัตน์ โชติกวณิชย์, พีร์พรรค์ เทพทอง

บทคัดย่อ

วัตถุประสงค์: *เพื่อเปรียบเทียบระยะเวลานอนโรงพยาบาล ระดับความเจ็บปวด การใช้ยากลุ่มโอปิออยด์ และภาวะแทรกซ้อนจากการผ่าท้องทำคลอดระหว่างหญิงตั้งครรภ์ที่ได้รับการส่งเสริมการฟื้นตัวหลังผ่าตัดและการรักษาแบบมาตรฐาน*

วัสดุและวิธีการ: *การศึกษาข้อมูลของหญิงตั้งครรภ์ที่ได้รับการผ่าท้องทำคลอดแบบไม่ฉุกเฉินแบบไปข้างหน้า จำนวน 80 คน ระหว่างเดือนมกราคมถึงพฤษภาคม พ.ศ. 2563 โดยหญิงตั้งครรภ์จำนวน 40 คนได้รับการรักษาในกลุ่มส่งเสริมการฟื้นตัวหลังผ่าตัด ในขณะที่อีก 40 คนได้รับการรักษาแบบมาตรฐาน ในกลุ่มส่งเสริมการฟื้นตัวหลังผ่าตัดประกอบไปด้วยการดูแลก่อนผ่าตัด ขณะผ่าตัดและหลังผ่าตัด มีการปรับเปลี่ยนการดูแลในกลุ่มส่งเสริมการฟื้นตัวหลังผ่าตัดจากการดื่มอาหารเหลวที่มีคาร์โบไฮเดรตเป็นการดื่มน้ำเปล่าเพื่อลดความเสี่ยงของการสำลักอาหารเข้าปอด การศึกษานี้มีวัตถุประสงค์หลักเพื่อเปรียบเทียบระยะเวลานอนโรงพยาบาล วัตถุประสงค์รองได้แก่ระดับความเจ็บปวด การใช้ยากลุ่มโอปิออยด์ และภาวะแทรกซ้อนจากการผ่าท้องทำคลอด*

ผลการศึกษา: *หญิงตั้งครรภ์ที่ได้รับการรักษาแบบส่งเสริมการฟื้นตัวหลังผ่าตัดมีระยะเวลาในการนอนโรงพยาบาลสั้นกว่า (3 วันและ 1.9 วัน, $p < 0.001$) การใช้ยากลุ่มโอปิออยด์น้อยกว่า ($p< 0.001$) ระดับความเจ็บปวดหลังผ่าตัดต่ำกว่า ($p< 0.001$) เมื่อเปรียบเทียบกลุ่มที่ได้รับการรักษาแบบมาตรฐานอย่างมีนัยสำคัญทางสถิติ นอกจากนี้ยังพบว่ามีระยะเวลาในการผายลมครั้งแรกเร็วกว่าในกลุ่มการรักษาแบบส่งเสริมการฟื้นตัวหลังผ่าตัดอีกด้วย (20 และ 40 ชั่วโมงหลังผ่าท้องทำคลอด) แต่อย่างไรก็ตามไม่พบว่ามีความแตกต่างกันของภาวะแทรกซ้อนระหว่างหญิงตั้งครรภ์ทั้งสองกลุ่ม*

สรุป: *การส่งเสริมการฟื้นตัวหลังผ่าท้องทำคลอดแบบไม่ฉุกเฉินเป็นวิธีที่มีประสิทธิภาพในการลดระยะเวลาในการนอนโรงพยาบาล การใช้ยากลุ่มโอปิออยด์ การลดระดับความเจ็บปวด และทำให้การทำงานของลำไส้เร็วยิ่งขึ้น โดยไม่พบว่ามีภาวะแทรกซ้อนที่แตกต่างกัน*

คำสำคัญ: *การส่งเสริมการฟื้นตัวหลังผ่าตัด การรักษาแบบมาตรฐานหลังผ่าตัด การผ่าท้องทำคลอดแบบไม่ฉุกเฉิน*

Introduction

Cesarean delivery (CD) is a life-saving procedure that is essential for the mother and fetus. The rate of CD is globally increasing in both developed and developing countries. In the same way, over the past three years, the CD rate at Rajavithi hospital, the tertiary care center, has increased by more than 50%. Sequelae of the increasing rate of CD increases risks of intraoperative and postoperative complications, length of hospital stay (LOS), postoperative opioid use, and the cost of the health care system.

Enhanced recovery after surgery (ERAS) is an evidence-based recommendation that standardizes perioperative care, patient safety, and health outcomes. It has been used worldwide in colorectal, urologic, gynecologic, and hepatobiliary surgery. ERAS comprises preoperative, intraoperative, and postoperative elements. The main elements of ERAS in CD primarily emphasize the clinical process for maternal care by a multidisciplinary team to guide preadmission information, education, counseling, and maternal comorbidities[1]. The intraoperative and postoperative elements pathways start 30 to 60 minutes before the cesarean incision and end at maternal discharge from the hospital[2]. The results have shown reductions in LOS, complications, readmissions, and health system costs[3].

However, ERAS in CD protocol is not routinely practiced in our hospital, and it is not consistent with the national guideline. Furthermore, in a developing country, there are few well-designed studies about ERAS in CD[4]. Therefore, we conduct this study to determine the primary objective of whether ERAS protocol can shorten LOS. The secondary objective was pain score, time to bowel function after surgery, the dosage of opioids, and bowel function after surgery compared to standard care.

Materials and Methods

This prospective cohort study included 80 pregnant women undergoing elective CD at the Department of Obstetrics and Gynecology, Rajavithi hospital, Thailand, between January and May 2020. The pregnant women were assigned to either ERAS protocol or standard care in a ratio of 1 to 1. Forty patients at ward A were assigned to ERAS protocol, and the remaining 40 at ward B were determined under standard care. The ERAS protocol composes of preoperative, intraoperative, and postoperative elements. We omitted venous thromboprophylaxis from this protocol. Pregnant women with complications as follow: preeclampsia with a severe feature, uncontrolled diabetes mellitus, severe medical disease, morbid obesity, chorioamnionitis, and postpartum hemorrhage, which more than or equal to 1,500 mL were excluded. Only those who could communicate in Thai participated in the study, and written informed consent was obtained from all pregnant women. The group assignments were disclosed to the surgeon and staff in the operative room, while the assessors were blinded during the study. This study was approved by the institutional review board of Rajavithi hospital (IRB number: 62099).

The preoperative ERAS element

Informing the patient about procedures before, during, and after CD and giving the medication (intravenous ranitidine and metoclopramide) to prevent aspiration pneumonitis were performed. Encouraging pregnant women to drink water 30 mL instead of a clear carbohydrate liquid diet until two hours before CD was modified from traditional ERAS. Oral or mechanical bowel preparation was not used before CD.

The intraoperative ERAS element

Prophylactic antibiotics were given within 60 minutes before skin incision, and the vagina was clean with povidone-iodine. Spinal anesthesia with morphine was administered. For all pregnant women, both ERAS and standard care, chlorhexidine-alcohol was used for abdominal skin cleansing and a warming device to prevent hypothermia. Regarding the cesarean section technique in our hospital, blunt expansion of a transverse uterine incision and closure of the incisional wound in two layers was performed in both groups. In ERAS protocol, only patients with subcutaneous tissue thick more than and equal to 2 cm were reapproximated,

and all patients received local wound anesthesia with bupivacaine.

The postoperative ERAS element

An antiemetic agent (ondansetron) was administered to prevent nausea and vomiting, and multimodal anesthesia that included ibuprofen and acetaminophen was used. The postoperative prescription of the type of opioid, whether meperidine, tramadol, and morphine, depended on the surgeon or anesthesiologist's preference. The pain scores equal to and more than four are the indications for giving opioids according to WHO pain management guidelines. Furthermore, early step diet, mobilization, intravenous fluid, and urinary catheter removal were also included in the ERAS group. On the other hand, in the standard care, patients were fed when bowel function was detected, intravenous fluid and urinary catheter were removed 24 hours after CD. The hospital discharge criteria were afebrile, tolerating a soft diet, no nausea, flatus, well-controlled pain, and good mobilization. Post-discharge follow-up was performed within six weeks at the postpartum clinic. All elements are shown in Table 1.

Table 1. Comparison of preoperative, intraoperative, and postoperative elements between the standard care and ERAS.

Elements	Contents	Standard care	ERAS
Preoperative	Patient education about the procedure of CD	Yes	Yes
	NPO at least 8 hours before CD	Yes	No
	Drinking water 30 mL until 2 hours before CD	No	Yes
	Bowel preparation (unison enema)	Yes	No
	Prevention of aspiration (H2 antagonist and Metoclopramide)	No	Yes
Intraoperative	Prophylactic antibiotics	At operative room	Within 60 minutes before CD
	Vaginal cleansing with Povidone-iodine	No	Yes
	Abdominal skin cleansing chlorhexidine-alcohol	Yes	Yes
	Regional (spinal) anesthesia	Depending on indication of CD	Yes
	Prevent hypothermia (a warming device)	Yes	Yes
	Re-approximation of subcutaneous tissue	Yes	Thickness ≥ 2 cm
	Local wound anesthesia	No	Yes
Postoperative	Pain control	Acetaminophen	Acetaminophen and NSAIDs
	Prevent nausea with 5-HT3 antagonist	No	Yes
	Early feeding	No	Yes
	Early ambulation	No	Yes
	Early IV catheter removal	No	Yes
	Early urethral catheter removal	No	Yes

CD: cesarean deliveries, ERAS: enhanced recovery after surgery, NPO: nothing per mouth, IV: intravenous, NSAIDs: non-steroidal anti-inflammatory drugs

The primary objective was LOS. The LOS was defined as the duration from the surgery to hospital discharge. The secondary objectives were pain score, a dosage of opioids, time to bowel function after surgery, and complications of CD compared between the ERAS and standard group. The pain score at 6 hours, the first and the second day after CD was evaluated using a visual analog scale. Time to flatus reflected bowel function recovery. Fever, wound dehiscence, and readmission were recorded as complications. Patient characteristics and operative factors were recorded. The LOS, pain score, the dosage

of opioids, time to bowel function, and complications were also retrieved.

The sample size was estimated based on a pilot study that revealed the mean LOS ± standard deviation (SD) after ERAS protocol, and the standard care were 2 ± 1 and 3 ± 1.75 days. Two independent means with an alpha error of 5%, 80% power, and a ratio of 1:1 were tested with a dropout rate of 25%. Therefore, the number of participants was 40 in each group. All statistical calculations were done using the SPSS statistics software package, version 22.0. Continuous variables were shown as mean and SD and compared by a student's t-test. Categorical variables were expressed as a number and a percentage, compared by a Fisher's exact and Pearson's chi-squared test. A p value less than 0.05 was considered statistical significance.

Results

According to 80 pregnant women who underwent elective CD. Table 2 shows pregnant women's baseline characteristics compared standard care and the ERAS. No significant differences were found in the two groups regardless of age, body mass index, nationality, fetal presentation, gestational age, maternal disease, antenatal complication, and surgeon level.

Table 2. Baseline characteristics of pregnant women comparing between the standard care and ERAS.

Characteristic	Standard care	ERAS	p value
Age (mean ± SD)	30.3 ± 5.2	30.4 ± 6.4	0.156
Body mass index (median) (min-max)	27.6 (19.2 - 35.1)	28.3 (20.4 - 36.1)	0.456
Nationality			0.166
Thai	29 (72.5%)	28 (70%)	
Other	11 (27.5%)	12 (30%)	
Fetal-presentation			0.456
Vertex	32 (80%)	36 (90%)	
Breech	6 (15%)	3 (7.5%)	
Vertex/breech	2 (5%)	1 (2.5%)	
Gestational age (median) (min-max)	39 (34 - 40)	39 (37 - 40)	0.901
Underlying disease			0.547
None	38 (95%)	35 (87.5%)	
Hypertension	1 (2.5%)	1 (2.5%)	
Autoimmune disease	0 (0%)	1 (2.5%)	
Other	1 (2.5%)	3 (7.5%)	
Antenatal complication			0.685
None	32 (80%)	35 (87.5%)	
Gestational Diabetes Mellitus	4 (10%)	3 (7.5%)	
Gestational hypertension	1 (2.5%)	1 (2.5%)	
Preeclampsia without severe feature	2 (5%)	0 (0%)	
Other	1 (2.5%)	1 (2.5%)	
Surgeon			0.576
Resident	31 (77.5%)	33 (82.5%)	
Staff	9 (22.5%)	7 (17.5%)	

ERAS: enhanced recovery after surgery, SD: standard deviation

Table 3. reveals the operative factors of pregnant women. There were no significant differences in intraoperative fluid, operative time, and intraoperative blood loss. However, there were unbalanced indications

of CD between the two groups. In the ERAS group, there were more CD due to previous cesarean section (77.5% vs 32.5%), but less fetal macrosomia and short maternal stature (5% vs 37.5%) compared to the standard group ($p < 0.001$). Additionally, in ERAS protocol, the goals were early step diet and intravenous catheter removal, so postoperative fluid was smaller than the standard care (2,250 ± 577 mL vs 500 ± 0 mL, $p < 0.001$).

Table 3. Comparison of the operative factors of pregnant women between the standard care and ERAS.

Operative factors	Standard care	ERAS	p value
Intraoperative fluid (mL) (mean ±SD)	1423 ± 312	1456 ± 261	0.175
Operative time (minute) (mean ± SD)	73.3 ± 25.4	71.9 ± 14.7	0.764
Indications			< 0.001
Twin	3 (7.5%)	1 (2.5%)	
Abnormal position	2 (5%)	3 (7.5%)	
Fetal macrosomia/ short maternal stature	15 (37.5%)	2 (5%)	
Previous cesarean delivery	13 (32.5%)	31 (77.5%)	
Placenta previa	2 (5%)	0 (0%)	
Other	5 (12.5%)	3 (7.5%)	
Blood loss (mL) (median) (min-max)	300 (100-800)	300 (100-600)	0.704
Postoperative fluid (mL) (mean ± SD)	2,250 ± 577	500 ± 0	< 0.001

ERAS: enhanced recovery after surgery, mL: milliliters, SD: standard deviation

Table 4 identifies the outcomes of the study. In the ERAS group, the LOS was statistically significantly shorter (1.9 vs 3 days, $p < 0.001$). This study also showed the statistical significance of decreasing time to flatus in the ERAS protocol (20 hours vs 40 hours, $p < 0.001$). The complication of CD was comparable between the two groups. In the standard group, one patient had an unknown cause of fever and was discharged without an uneventful event.

Table 4. The outcomes comparing between the standard care and ERAS.

The outcomes	Standard care	ERAS	p value
Length of stay (days) (median) (min-max)	3.0 (1.9 - 4.9)	1.9 (1.8 - 3.0)	< 0.001
Opioids use			< 0.001
None	5 (12.5%)	39 (97.5%)	
Meperidine	8 (20%)	0 (0%)	
Tramadol	20 (50%)	0 (0%)	
Morphine	7 (17.5%)	1 (2.5%)	
Complications			1.000
None	39 (97.5%)	40 (100%)	
Fever	1 (2.5%)	0 (0%)	
Time to flatus (hours) (median) (min-max)	40 (30 - 49)	20 (15 - 26)	< 0.001
Pain score (Median) (Min-Max)			
6 hours post-operation	8 (5-10)	5 (0-10)	< 0.001
The first day	4 (0 - 8)	1 (0-3)	< 0.001
The second day	3 (0 - 5)	0 (0-2)	< 0.001

ERAS: enhanced recovery after surgery

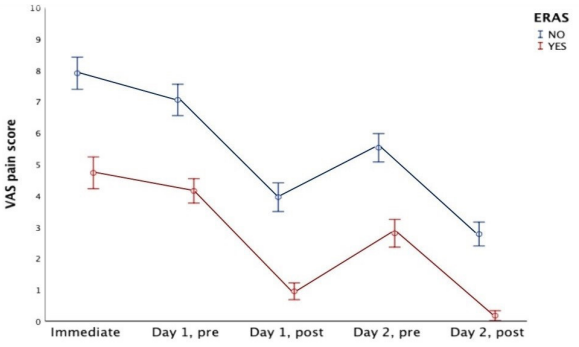

Fig. 1. Repeated measure ANOVA showed the difference of pain score.
ANOVA: analysis of variation, VAS: visual analog scale, ERAS: enhanced recovery after surgery,
Pre: before take analgesic pill, Post: after take analgesic pill.

For pain control, a significant reduction in opioid use was found in the ERAS group ($p < 0.001$). Only one patient (2.5%) in the ERAS group asked for morphine, while 17.5%, 50%, and 20% of the patients in the standard care requested pain killers such as morphine, tramadol, and meperidine consequently. As shown in Fig.1, the pain score at six hours after the operation, the first and the second day significantly reduced in the ERAS group (8 vs 5, 4 vs 1, and 3 vs 0, $p < 0.001$). No evidence of hospital readmission was found in our study.

Discussion

ERAS is a perioperative care program that has been shown to provide clinical benefits (reductions in LOS, complications of CD, and readmission) and health system benefits (reduced hospital cost)[3, 5]. Initially, ERAS was implemented in colorectal surgery nearly 15 years ago, and now there is more widespread use in different surgical specialties, including gynecologic surgery[6].

Several studies demonstrated a reduction of the LOS in ERAS planned CD without increasing readmission and complication rates[6-10]. In the same way, a randomized controlled trial from low-income countries also reported a shorter LOS when using ERAS protocol in emergency CD and a lower incidence of severe pain[4]. In the aspect of opioid use, a retrospective cohort study, implementing ERAS protocol can decrease opioid consumption[10, 11]. Consistent with the previous studies, there was also a statistically significant shorter LOS and reduced opioid use under ERAS protocol compared to standard care in this study. Moreover, a shorter time to flatus and reduced postoperative pain score were found among patients with ERAS protocol. However, in another randomized controlled trial that compared ERAS and the standard care in nonemergent CD, ERAS protocol was not associated with postoperative narcotic use[6]. However, the implementation of ERAS CD in another retrospective study was no statistical change in the LOS outcome, but there was decrease mean of inpatient opioid exposure[11].

Due to the physiology of pregnancy, pregnant women tend to have a risk of aspiration. In the present study, we are seriously concerned about aspiration pneumonitis after preoperative drinking a clear carbohydrate liquid diet in CD. For this reason, we modified the ERAS protocol from a preoperative carbohydrate liquid diet to water. The use of modified ERAS CD, according to our study, has many clinical benefits, including shortening the LOS, reducing pain score, fasten bowel function recovery. For pain control, implementation of ERAS can diminish unnecessary opioid exposure shift to other pain killers such as Acetaminophen and NSAIDs. There was no difference in adverse outcomes after ERAS implementation. Eventually, these interventions may lessen healthcare costs and hospital resources.

The study's main strengths were a prospective cohort study, and the original ERAS was modified to

suit the hospital context. Furthermore, ERAS protocol was anticipated with a multidisciplinary team such as anesthesiologists and nurses. In addition, this is the first study that modified the ERAS protocol using preoperative water instead of a clear carbohydrate liquid diet. On the other hand, there were several limitations in this study. First, there were unbalanced indications for CD between the two groups that may affected the outcomes. Second, we did not enroll the pregnant women who had conditions for the emergency CD because of the difficulty of controlling in preoperative element. Third, information about breastfeeding was not included in the study's objective. Last, cost-effective analyses in ERAS were not evaluated.

Conclusion

ERAS protocol in elective CD effectively reduces LOS, opioid use, pain score and improves bowel function without significant complications.

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Potential conflicts of interest

The authors declare no conflicts of interest.

References

1. Wilson RD, Caughey AB, Wood SL, Macones GA, Wrench IJ, Huang J, et al. Guidelines for antenatal and preoperative care in cesarean delivery: enhanced recovery after surgery society recommendations (Part 1). Am J Obstet Gynecol 2018;219:523-32.
2. Caughey AB, Wood SL, Macones GA, Wrench IJ, Huang J, Norman M, et al. Guidelines for intraoperative care in cesarean delivery: enhanced recovery after surgery society recommendations (Part 2). Am J Obstet Gynecol 2018;219:533-44.
3. Macones GA, Caughey AB, Wood SL, Wrench IJ, Huang J, Norman M, et al. Guidelines for postoperative care in cesarean delivery: enhanced recovery after surgery (ERAS) Society recommendations (part 3). Am J Obstet Gynecol 2019;221:247.e1-247.e9.
4. Baluku M, Bajunirwe F, Ngonzi J, Kiwanuka J, Ttendo S. A randomized controlled trial of enhanced recovery after surgery versus standard of care recovery for emergency cesarean deliveries at Mbarara Hospital, Uganda. Anesth Analg 2020;130:769-76.
5. Steenhagen E. Enhanced recovery after surgery: It's time to change practice. Nutr Clin Pract 2016;31:18-29.
6. Teigen NC, Sahasrabudhe N, Doulaveris G, Xie X, Negassa A, Bernstein J, et al. Enhanced recovery after surgery at cesarean delivery to reduce postoperative length of stay: a randomized controlled trial. Am J Obstet Gynecol 2020;222:372.e1-372.e10.
7. Corso E, Hind D, Beever D, Fuller G, Wilson MJ, Wrench IJ, et al. Enhanced recovery after elective caesarean: a rapid review of clinical protocols, and an umbrella review of systematic reviews. BMC Pregnancy Childbirth 2017;17:91-101.
8. Fay EE, Hitti JE, Delgado CM, Savitsky LM, Mills EB, Slater JL, et al. An enhanced recovery after surgery pathway for cesarean delivery decreases hospital stay and cost. Am J Obstet Gynecol 2019;221:349.e1-349.e9.
9. Bowden SJ, Dooley W, Hanrahan J, Kanu C, Halder S, Cormack C, et al. Fast-track pathway for elective caesarean section: a quality improvement initiative to promote day 1 discharge. BMJ Open Qual. 2019;8:e000465.
10. Shinnick JK, Ruhotina M, Has P, Kelly BJ, Brousseau EC, O'Brien J, et al. Enhanced recovery after surgery for cesarean delivery decreases length of hospital stay and opioid consumption: a quality improvement initiative. Am J Perinatol 2020;7:356-65.
11. Hedderson M, Lee D, Hunt E, Lee K, Xu F, Mustille A, et al. Enhanced recovery after surgery to change process measures and reduce opioid use after cesarean delivery: a quality improvement initiative. Obstet Gynecol 2019;134:511-9.