Thai Journal of Obstetrics and Gynaecology
November 2022, Vol. 30, No. 6, pp. 393-402.

OBSTETRICS

Effectiveness of the Enhanced Recovery after Surgery (ERAS) Protocol Following Elective Cesarean Section: A single-center randomized controlled trial

Nutchar Klangprapan, M.D.*,
Amarin Narkwichean, M.D. Ph.D.*,
Jutarat Luanpholcharoenchai, M.D.**,
Wipada Laosooksathit, M.D.*

** Department of Obstetrics and Gynecology, Faculty of Medicine, Srinakharinwirot University, Nakhon-nayok, Thailand*
*** Department of Anesthesiology, Faculty of Medicine, Srinakharinwirot University, Nakhon-nayok, Thailand*

ABSTRACT

Objectives: To compare 24 hours postoperative recovery utilizing the quality of recovery questionnaire (QoR-35, Thai version) and pain assessment using the visual analogue scale (VAS) between pregnant women scheduled for elective cesarean section receiving enhanced recovery after surgery (ERAS) and standard protocol.

Materials and Methods: A randomized controlled trial was performed in 48 singleton pregnancy patients scheduled for elective cesarean section using the ERAS protocol and the standard protocol at HRH Princess Maha Chakri Sirindhorn Medical Center (MSMC). The 24-hour postoperative recovery and pain score were assessed to compare postoperative recovery. Postoperative complications after 72 hours postpartum were compared between two protocols.

Results: A total of 48 term-pregnant women were included in the study. Five women were excluded, leaving 43 participants (21 participants in the ERAS protocol group and 22 participants in the standard protocol group). As per the protocol analyses, the median (interquartile range (IQR)) of QoR-35 scores were 153.7 (± 10.2) and 149 (± 32), $p = 0.20$ in the ERAS group and standard group, respectively. The mean (± standard deviation (SD)) pain scores 24-hours postoperatively were 3.1 (±1.9) and 5.1 (±1.9), $p < 0.05$ in the ERAS and standard protocol groups, respectively. There was no postoperative complication reported.

Conclusion: There was no statistically significant difference between QoR-35 scores. However, the pain dimension with the ERAS protocol was significantly lower than in the standard care group and no complications were found 72 hours after surgery. The study found that the ERAS protocol was able to significantly reduce postoperative pain without increasing the negative impact on the surgical outcome.

Keywords: cesarean section, enhancing recovery, quality of recovery, pain

Correspondence to: *Wipada Laosooksathit, M.D., Department of Obstetrics and Gynecology, Faculty of Medicine, Srinakharinwirot University, Ongkharak, Nakhon Nayok 26120, Thailand.*
E-mail: Wipada@g.swu.ac.th

ประสิทธิผลโปรโตคอลเสริมการฟื้นตัว (ERAS) ในการผ่าตัดคลอด งานวิจัยแบบสุ่มมีกลุ่มควบคุม

ณัฐชา กลางประพันธ์, อมรินทร์ นาควิเชียร, จุฑารัตน์ เลื่อนผลเจริญชัย, วิภาดา เหล่าสุขสถิตย์

บทคัดย่อ

วัตถุประสงค์: *เปรียบเทียบการฟื้นตัวหลังผ่าตัดโดยแบบสอบถามคุณภาพการฟื้นตัวฉบับภาษาไทย 35 และประเมินความเจ็บปวดโดยเครื่องมือวัดความเจ็บปวดระหว่างหญิงตั้งครรภ์ที่นัดมาผ่าตัดคลอดในกลุ่มที่ได้รับการดูแลโดยโปรโตคอลเสริมการฟื้นตัวหลังผ่าตัด (enhanced recovery after surgery (ERAS) protocol) และได้รับการดูแลตามมารตรฐาน (Standard protocol)*

วัสดุและวิธีการ: *การศึกษาเป็นแบบสุ่มและมีกลุ่มควบคุม ทำในประชากรหญิงตั้งครรภ์เดี่ยวที่นัดมาเพื่อผ่าตัดคลอดโดยได้รับการดูแลโดยโปรโตคอลเสริมการฟื้นตัวหลังผ่าตัด (ERAS protocol) และได้รับการดูแลตามมารตรฐาน (Standard protocol) โดยเก็บข้อมูลจากผู้ป่วย 48 คน ที่ศูนย์การแพทย์สมเด็จพระเทพรัตนราชสุดาฯสยามบรมราชกุมารี ประเมินการฟื้นตัวหลังผ่าตัดที่ 24 ชั่วโมง และคะแนนความเจ็บปวดและเปรียบเทียบภาวะแทรกซ้อนหลังผ่าตัดที่ 72 ชั่วโมง ระหว่างการดูแลทั้ง 2 รูปแบบ*

ผลการศึกษา: *หญิงตั้งครรภ์ครบกำหนดในการศึกษาจำนวน 48 คน มีจำนวนผู้เข้าร่วมการศึกษา 5 คน ที่ถูกนำออกจากการศึกษาทำให้เหลือผู้เข้าร่วมการศึกษาจำนวน 43 คน แบ่งเป็นกลุ่มที่ได้รับการดูแลโดยโปรโตคอลเสริมการฟื้นตัวหลังผ่าตัด (ERAS group) จำนวน 21 คน และกลุ่มที่ได้รับการดูแลตามมาตรฐาน (Standard group) จำนวน 22 คน การวิเคราะห์ข้อมูลในรายที่มีข้อมูลสมบูรณ์ (Per protocol analysis) ค่าเฉลี่ยคะแนนแบบสอบถามประสิทธิภาพการฟื้นตัวหลังผ่าตัวเท่ากับ 153.7 (±10.2) and 149 (± 32), p = 0.20 ในกลุ่มที่ได้รับการดูแลโดยใช้โปรโตคอล ERAS และกลุ่มที่ได้รับการดูแลตามมาตรฐานตามลำดับ และค่าเฉลี่ยคะแนนความเจ็บปวดที่ 24 ชั่วโมงหลังผ่าตัดเท่ากับ 3.1 (±1.9) และ 5.1 (±1.9), p < 0.05 ในกลุ่มที่ได้รับการดูแลโดยใช้โปรโตคอล ERAS และกลุ่มที่ได้รับการดูแลตามมาตรฐานตามลำดับ โดยไม่พบภาวะแทรกซ้อนหลังผ่าตัดของผู้เข่าร่วมการศึกษาทั้ง 2 กลุ่ม*

สรุป: *จากการศึกษาไม่พบความแตกต่างอย่างมีนัยสำคัญทางสถิติระหว่างคะแนนแบบสอบถามประสิทธิภาพการฟื้นตัวหลังผ่าตัดฉบับภาษาไทยระหว่างกลุ่มที่ได้รับการดูแลโดยโปรโตคอลเสริมการฟื้นตัวหลังผ่าตัด (ERAS protocol) และกลุ่มที่ได้รับการดูแลตามมาตรฐาน (Standard protocol) อย่างไรก็ตามด้านความเจ็บปวดหลังผ่าตัดพบว่ากลุ่มที่ได้รับการดูแลโดยโปรโตคอลเสริมการฟื้นตัวหลังผ่าตัดมีคะแนนความเจ็บปวดที่น้อยกว่าอย่างมีนัยสำคัญทางสถิติและไม่พบว่ามีภาวะแทรกซ้อนหลังผ่าตัดที่ 72 ชั่วโมง การศึกษาพบว่าการดูแลโดยโปรโตคอลเสริมการฟื้นตัวหลังผ่าตัดสามารถที่จะลดความเจ็บปวดหลังผ่าตัดได้อย่างมีนัยะสำคัญทางสถิติโดยไม่พบผลลบต่อผลของการผ่าตัด*

คำสำคัญ: *การผ่าตัดคลอดบุตร, เสริมการฟื้นตัว, ประสิทธิภาพการฟื้นตัว, อาการปวด*

Introduction

Cesarean section is a life-saving surgical procedure, with its rate of use continuously increasing over the past decades. A study in Southeast Asia covering the period 1990 - 2014 demonstrated a total rate of cesarean section at 14.8%[1]. In Thailand, the rate of cesarean section increased from 20.7% in 2001 to 39.4% in 2014[2]. However, cesarean section is considered a complicated childbirth delivery and incurs a longer hospital stay and a 4 - 5 fold increase in maternal morbidity/mortality when compared to vaginal delivery[3]. Cesarean section morbidities, including infection, hemorrhage, gastrointestinal complications, and injuries to adjacent organs, are primarily related to the obstetrics and intraoperative conditions; albeit proper postoperative care is able to prevent and reduce the severity of the complications[4, 5]. There are a number of established interventions that promote recovery, including early ambulation, early feeding, and the reduction of postoperative pain. These practices can reduce the length of hospital stay, the cost of treatment, increase patient satisfaction and promote faster patient recovery[6-9].

The enhanced recovery after surgery (ERAS) protocol was first introduced in the 1990s by Dr Henrik Kehlet, a colorectal surgeon, to promote faster recovery and reduce the complications after surgery. Currently, ERAS guidelines have been developed for various procedures, including orthopedic, gynecologic oncology, pediatric, gastrointestinal/colorectal, and for breast, lung, and cesarean section surgery[10]. These protocols fasten recovery time by 30% and reduce complications by up to 50%[11]. The ERAS guidelines for cesarean section, published between 2018 - 2019, focus on the patient care process. The protocols include preoperative, intraoperative, and postoperative care to increase the efficiency of postoperative recovery[8, 12, 13]. Nevertheless, the effectiveness of the ERAS cesarean section protocol has been evaluated in only a few studies. To the best of our knowledge, no published or ongoing study comparing the treatment performance between pregnant women receiving the ERAS protocol and standard postoperative care has yet been conducted in Thailand. Consequently, we conducted a randomized controlled trial to compare the postoperative recovery effectiveness of pregnant women scheduled for cesarean section when using the ERAS protocol and when using the standard protocol. The effectiveness of recovery was determined at 24 hours postoperatively utilizing the quality of recovery questionnaire (QoR-35 Thai version, with permission from Pitimana-aree et al[14]. The questionnaire is designed to assess 5 dimensions of the patient's postoperative condition, i.e. comfort, emotional, physical independence, patient support, and pain, and is available in a Thai-translated edition with confirmed test validity (QoR-35 Cronbach's alpha 0.91). The QoR-35 is selected because it can assess multiple dimensions when compared with the other questionnaires reflecting more thorough evaluation of the patient recovery quality. Furthermore, this tool has been translated and modified to be appropriate to the Thai population. The safety aspects of the intervention, concerning the pain score and postoperative complications, were also evaluated.

Our objective was to compare the effectiveness of 24 hours postoperative recovery in pregnant women scheduled for elective cesarean section between the enhanced recovery after surgery (ERAS) protocol and the standard protocol. The recovery was assessed using the quality of recovery questionnaire (QoR-35, Thai version) while additional pain assessment was performed using the visual analogue scale (VAS).

Materials and Methods

A randomized controlled trial was conducted at the Department of Obstetrics and Gynecology, HRH Princess Maha Chakri Sirindhorn Medical Center (MSMC), Srinakharinwirot University Hospital, during the period between June 2020 and December 2020. The research received appropriate approval from the institutional review board (IRB) (SWUEC-019/2563F). The study protocol was registered in the Thai Clinical Trial Registry (https://www.thaiclinicaltrial.org) (TCTR20210705001).

The sample size was estimated using the two-independent, continuous-outcome formula anticipating

an alpha of 0.5 and 80% power. The baseline QoR-35, as reported by Pitimana-aree et al[14] was 149.4 (±17). To detect a 10% increase plus 20% dropout, a total of 48 participants, 24 in each group, was required for the study. A total of 108 participants were assessed for eligibility, of whom 48 participants consented to participate and were randomly assigned to receive either the ERAS or the standard protocol. The study flow of participants was presented in Fig. 1. The participants were scheduled for elective cesarean section at 37 - 42 weeks' gestation, aged between 20 - 40 years old, and had conceived a singleton pregnancy without obstetrics or medical complications. Obstetrics complications were defined as either abnormal placentation (placenta previa or placenta accrete syndrome) or pregnancy-induced medical complications, such as gestational diabetes or hypertensive disorders in pregnancy. Medical complications included existing pre-gestational medical illnesses that required medication treatment. The participants were not contraindicated for using cefazolin, non-steroid anti-inflammatory drugs (NSAIDs), or metoclopramide. Women who subsequently either had a postpartum hemorrhage, received (or were converted to) general anesthesia, underwent an emergency cesarean section, or demonstrated unstable postoperative conditions (shock, anaphylaxis, respiratory distress) were excluded from the trial. Information regarding the study was given during antenatal visits. Written informed consent was obtained from all participants at their admission (1 day prior to the operation). The participants were then randomly assigned into 2 groups: those receiving either ERAS or standard postoperative care, using a block randomization (block of four) method.

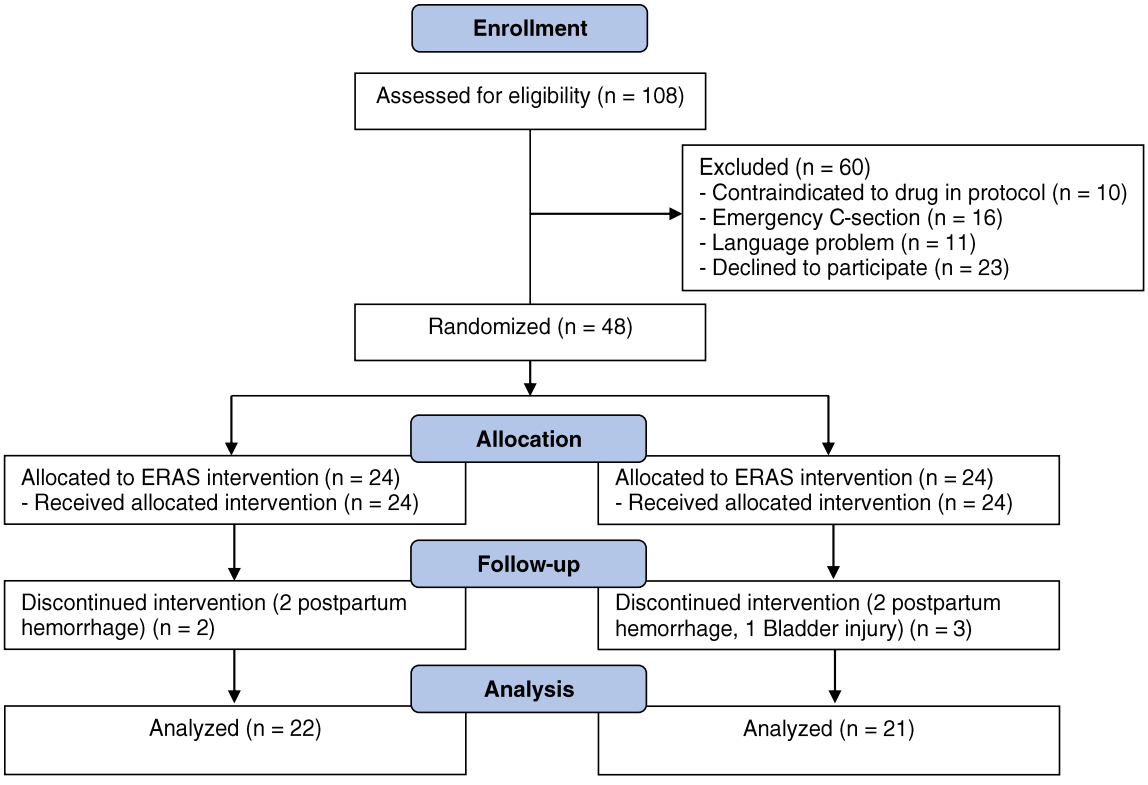


Fig. 1. Study flow of the participants.

Detailed information regarding both the operative protocols is provided in Table 1. All the participants received the same preoperative preparation, except patients in the ERAS group were given 50 ml water

containing 50 gm glucose at 6:00 am on the day of the surgery. Spinal anesthesia was performed by an anesthesiologist using 10 mg of 0.5% heavy bupivacaine with 0.2 mg morphine. The ERAS participants received prophylactic 10 mg metoclopramide given intravenously, while the participants in the standard protocol group were given an antiemetic drug upon request when showing symptoms. All the patients were observed in the recovery room for 2 hours post-operation and then were moved to a postpartum ward. Early ambulation was advised for all the patients in both groups. In the ERAS group, the participants were promptly provided with fluids and food along with analgesic medication (oral paracetamol 500 mg every 6 hours and ibuprofen 400 mg every 8 hours), once the postoperative vital signs were stabilized. Nonetheless, all the participants could request additional pain control regardless of their study group, with all additional medications further recorded. All medications from the study protocol and additional pain control were recorded and examined to assess the patient compliance and contamination of treatment protocol. To decrease the contamination of treatment, the case is indicated in which form of care using the patient chart symbol. The participants were unblinded with intervention, but the outcome assessors were blinded from the study protocol.

Table 1. Components of intervention between ERAS and standard protocol in cesarean delivery.

ERAS protocol	Standard protocol
Preoperative	**Preoperative**
Explain the indications for the procedure, the preparation before surgery, the possible complications, and the recovery time after surgery	Explain the indications for the procedure, the preparation before surgery, the possible complications, and the recovery time after surgery
Giving patients water to drink: a solution containing 50 gm of glucose in 50 ml of water at 6.00 am on the day of surgery	NPO after midnight
Intraoperative	**Intraoperative**
Anesthesia by spinal anesthesia, euvolemic status, and prevention of hypothermia	Anesthesia by spinal anesthesia, euvolemic status, and prevention of hypothermia
Metoclopramide 10 mg intravenous after spinal anesthesia	Giving the patient an antiemetic drug if the patient feels nausea or vomiting after spinal anesthesia
Purify the skin around the surgery with an antiseptic	Purify the skin around the surgery with an antiseptic;
Apply antibiotic prophylaxis (cefazolin) 30 - 60 minutes before the procedure before surgery	Apply antibiotic prophylaxis (cefazolin) 30 - 60 minutes before the procedure before surgery
Postoperative	
Giving patients the ability to eat water and food immediately after surgery 2 hours after the general symptoms and vital signs stabilize	Step diet after surgery.
Paracetamol 500 mg given every 6 hours with NSAIDs (ibuprofen 400 mg) every 8 hours	Giving paracetamol painkiller at 500 mg according to the patient pain and adding other painkillers if this did not provide enough pain relief
Extra analgesics: tramadol 50 mg IV prn every 8 hours	Extra analgesics: tramadol 50 mg IV prn every 8 hours
Early ambulation	**Early ambulation**
Removal of the urinary catheter 6 hours after surgery	Removal of the urinary catheter 12-24 hours after surgery

ERAS: enhanced recovery after surgery, IV: intravenous, PRN: pro re nata

The quality of recovery was evaluated using the QoR-35 (Thai version) 24-hours postoperatively. The QoR-35 is a self-evaluation questionnaire consisting of 35 questions, worth 5 points each, so 175 points in total, divided into 5 dimensions, as mentioned above. A high total score indicates a good postoperative recovery performance. Concurrently, the pain score was assessed using the VAS. All the participants were hospitalized for at least 72 hours post-operation according to the original departmental policy, unless there was a complication. The participants were asked to visit either a hospital or clinic in their neighborhood to assess the surgical wound at 7 days following the surgery. All the participants visited the clinic at MSMC at 6 weeks for postpartum follow-up. The wounds and puerperium complications were recorded.

Statistical analysis

Descriptive statistics: the mean (standard deviation (SD)), median (interquartile range (IQR)), or proportion (%) were used where appropriate. Either the student t test, Mann - Whitney U test, or chi square

test was used when appropriate to detect differences in the variables between the intervention groups. The study was planned for per-protocol analysis. Comparison of both the mean QoR-35 (primary outcome) and pain score (secondary outcome) at 24-hours postoperatively was done by the student t-test method. The convergent validity of the Thai version of QoR-35 was reported in the literature[14]. The incidences of postoperative complications were compared using the chi-square test. A p value of 0.05 was determined significant and the 95% confidence interval (CI) was estimated. All the statistical analyses were performed using the Statistical Package for Social Sciences (SPSS) software version 23.0 (IBM, New York).

Results

In total, 48 term-pregnant women participated in the study and were equally and randomly assigned into 2 groups. Five women were excluded, comprising 4 with postpartum hemorrhage (2 from each group) and 1 from the standard group with intraoperative bladder injury. The remaining 43 women completed the study protocols, non-contamination of treatment observed, were included in the outcome analysis. All 43 participants visited the hospital for post-partum check-up and were thus able to participate in the study. At 6-week follow-up, no participant showed postpartum complications. The participants' mean age was 31.2 (± 5.5) years with a mean gestational age of 38.7 (± 0.5) weeks gestation. The main surgical indications were previous cesarean section (93.7 %), and breech presentation (6.3%). The average surgical time was 64.20 (± 17.65) minutes and the participants had an average blood loss of 560 (± 196.76) ml. Table 2 compares the demographic data between participants from the ERAS and standard protocols groups. There were no significant differences in both the general and operative data between the two groups.

Table 2. Baseline patient characteristics.

Characteristics	ERAS group (n = 24)	Standard group (n = 24)	p value
General information			
Maternal age (years)			
mean (SD)	32.5 (5.4)	29.9 (5.3)	0.10
BMI (kg/m^2)			
mean (SD)	25.0 (5.1)	26.2 (5.2)	0.42
Income (THB/month)			
15,000 - 29,999: n (%)	14 (58.3%)	18 (75%)	0.12
more than 30,000: n (%)	10 (41.7%)	6 (25%)	
Operative information			
Skin incision			
Low midline incision: n(%)	3 (12.5%)	1 (4.2%)	0.29
Pfannenstiel incision: n (%)	21 (87.5%)	23 (95.8%)	
Fetal presentation			
Vertex: n (%)	23 (95.8%)	22 (91.7%)	0.55
Breech: n (%)	1 (4.2%)	2 (8.3%)	
Previous cesarean delivery: n (%)			
0	1 (4.2%)	2 (8.3%)	0.24
1	17 (70.8%)	18 (75%)	
2	5 (20.8%)	4 (16.7%)	
3	1 (4.2%)	0 (0%)	
Operative times (minutes)			
mean (SD)	63.7 (17.5)	64.2 (17.0)	0.92
Operative blood loss (ml)			
median [IQR]	500 [277.5]	600 [287.5]	0.24

BMI: body mass index, THB: baht, SD: standard deviation, IQR: interquartile range

Concerning the primary outcome, the participants' recovery scores (QoR-35) were not significantly different between the two groups, although there was a higher trend noted in the ERAS group (median [IQR] 153.5 [14.5] vs. 149 [32], p = 0.20). Breakdown of the QoR-35 scores are shown in Table 3. There was no significant difference between the groups in all aspects, except for the pain dimension. The ERAS group demonstrated better pain control compared to the standard protocol (median [IQR]: 25.5 [4] vs 24 [5], p < 0.05).

Table 3. Detailed analysis on each QoR-35 dimension.

Dimension	ERAS group	Standard group	p value*
Comfort dimension			
median score [IQR]	52.5 [8.2]	53 [8.5]	0.76
Emotional dimension			
median score [IQR]	30.5 [5.2]	30 [7]	0.59
Physical dimension			
median score [IQR]	19.5 [2.5]	17 [7]	0.09
Support dimension			
median score [IQR]	29 [4.2]	29 [6]	0.86
Pain dimension			
median score [IQR]	25.5 [4]	24 [5]	< 0.05

* Mann–Whitney U test, ERAS: enhanced recovery after surgery, IQR: interquartile range

Correspondingly, the mean pain scores at 24 hours following cesarean section were significantly lower in the ERAS group when compared to the control standard postoperative care (mean (SD): 3.1 (1.9) vs. 5.1 (1.9); mean difference 2.0, 95% CI 0.8, 3.2, p < 0.05). Regarding the additional opioid use, the rate of opioid use in the ERAS group was 9.09% when compared to the 38.09% in the standard protocol (p < 0.05). Opioid doses administered 24-hours postoperatively were significantly lower in the ERAS group in comparison to in the standard protocol group. Neither immediate, 72-hour postoperative, nor 6-week postpartum complications were observed in all participants. Pain evaluation at 24 hours postoperatively was assessed by VAS (Table 4).

Table 4. Pain scores between protocol.

Pain score	ERAS group (n = 22)	Standard group (n = 21)
0-3	13 (59.1%)	5 (23.8%)
4-6	8 (36.4%)	9 (42.9%)
> 6	1 (4.5%)	7 (33.3%)

ERAS: ehanced recovery after surgery

Discussion

This randomized controlled study did not observe a significant improvement in the quality of recovery (QoR), despite observing a higher trend with the ERAS protocol. However, pain control at 24 hours after surgery, determined by both the QoR-35 pain dimension and the VAS, was significantly better in the patients in the ERAS. Although, more acetaminophen and ibuprofen were used during the first 24 hours, the rate of opioid usage in the ERAS protocol group was significantly lower than in the standard group (9.09% vs. 38.09%, p < 0.05).

Effective perioperative care is paramount for the successful prevention of postoperative complications, and reduction of the length of hospital stay and cost of treatment. Quality of the patient recovery can be determined in various aspects by a variety of tools; for example: i) activities of daily living (ADLs), ii) visual

analogue scale of recovery (VAS-R), and QoR-35 . The authors selected the QoR-35 for two reasons; first, it assesses five dimensions of a patient's recovery, namely comfort, emotional, physical independence, support, and pain, and second, the questionnaire was already available with a Thai-translated edition with confirmed test validity[15]. We also backed this up with the pain VAS to evaluate pain control, which is a major concern of both physicians and patients, along with the incidence of postoperative complications at 72 hours (during admission). The length of hospital stay was otherwise not included in the analysis because it is common practice in Thailand for patients to stay in the hospital for at least a fixed minimum of 72 hours according to the local guidelines.

To the best of our knowledge, this is the randomized control trial to evaluate the effectiveness of the ERAS protocol in elective, considered uncomplicated, cesarean section in Thailand. The sample size was calculated, and the study population encompassed a low rate of participant dropout and no postoperative complications. Nonetheless, we did not observe a difference in the overall QoR-35 scores. Our primary outcome finding contrasted with other studies showing that the ERAS protocol could enhance patient recovery[8, 12, 13], although these studies did not use the QoR-35 questionnaire. It is noteworthy that there were a few modifications in our ERAS protocol due to differences in the institutional context; for example, giving drinking water until 2 hours prior to the surgery was not used in our study. Moreover, despite being one of the major operations, cesarean section may spare some recovery aspects assessed by the questionnaire; thus, overall differences were not obvious. The sample size estimation was calculated to detect a 10% difference; however, in the current study we did observe such a sized difference, only a 5.64% QoR-35 higher in the ERAS group. The post-hoc analysis demonstrated that our use of the QoR-35 to assess effectiveness of recovery after cesarean section was under-power to detect a difference between the protocols, due to the reasons stated above. A questionnaire developed specifically to assess postoperative recovery in cesarean section would be more appropriate. Nonetheless, we suggest reconsidering to use all dimensions of QoR-35 to evaluation the postoperative recovery. Because some dimension such as emotional state or psychological support may affected by variable factors other than protocol intervention.

Nevertheless, an improvement in terms of pain control was observed in the current study. It is important to emphasize that, by using acetaminophen and NSAIDs, the ERAS could reduce the opioid (in our institution, tramadol) use by approximately 4 times. Our findings are supported by other evidence in the literature. Hedderson and colleague also demonstrated that the ERAS protocol could reduce opioid usage after cesarean delivery[16]. Moreover, a meta-analysis conducted in parallel to our study by Meng, et al showed that the ERAS could reduce postoperative pain and opioid use[17]. It is known that use of opioid postoperatively can produce various unfavorable effects, such as respiratory depression, nausea and vomiting, bowel dysfunction, urinary retention, and pruritus[18]. Two recent randomized controlled trials (RCTs)[19, 20], however, observed no difference in terms of narcotic used but the pain assessed by VAS was significantly reduced in the one study[20]. In our study, pain assessment as part of the QoR-35 also demonstrate 1.5 points mean difference referring to a more satisfaction in regards of pain control, i.e. less pain breakthrough. To sum up, data from our and other studies could therefore establish a conclusion that the ERAS is more superior in the pain-control aspect when compared to the standard post-operative protocol. Therefore, the decrease in opioid use is a result of pain control from the ERAS protocol. The advantage of this questionnaire was pain assessed focused during 24 hours after operation, pain assess-analgesic drug interval was unimportant. In different, the pain evaluated by VAS may influence. In term of additional opioid administration, we found that multimodal analgesia can reduce postoperative pain and reduce opioid use.

Other benefits of the ERAS following cesarean section reported in the literature are a reduction of the length of hospital stay and an improved cost-effectiveness[21-24]. As aforementioned, the study was conducted in such a way so as not to interfere with the

local practice in terms of the hospital stay; thus, we did not include the length of stay and the cost in the analysis. The authors, however, will promote further trials in the future, especially in an institution/situation where postpartum beds are limited.

The results showed that those who were unable to follow the protocol were not used for analysis. The results of the study may be inferred that the outcomes of the protocols were different depend on the patient care. However, the study did not assess patient satisfaction, which could inform the effectiveness of the ERAS protocol in another way. Therefore, if the ERAS protocol can be used for pregnant patients in Thailand, the researcher expects that although the treatments are not significantly different, we can take advantage from the control pain process.

Conclusion

In conclusion, the ERAS protocol enhanced patient recovery following elective cesarean section, at least in the pain control aspect and without causing harm to the patient. Further studies with larger participants are encouraged to evaluate other aspects of 'quality recovery'. More studies should also be carried, with a few modifications to the protocol, for other forms of surgery, e.g., emergency cesarean section.

Acknowledgement

The authors would like to thank the Department of Anesthesiology for facilitating the study during the operations and the Faculty of Medicine, Srinakharinwirot University for providing funding for the research.

Potential conflicts of interest

The authors declare no conflicts of interest.

References

1. Betrán AP, Ye J, Moller AB, Zhang J, Gülmezoglu AM, Torloni MR. The increasing trend in caesarean section rates: global, regional and national estimates: 1990-2014. PLoS One 2016;11:e0148343.
2. Yukaew N. Cesarean section rate according to Robson's classification. J Prev Med Assoc Thai 2017;7:262-71.
3. Gupta M. Caesarean Section: Mortality and Morbidity. J Clin Diagn Res 2018;12:QE01-QE06.
4. Quinlan JD, Murphy NJ. Cesarean delivery: counseling issues and complication management. Am Fam Physician 2015;91:178-84.
5. Field A, Haloob R. Complications of caesarean section. The Obstetrician & Gynaecologist 2016;18:265-72.
6. Ljungqvist O, Scott M, Fearon KC. Enhanced Recovery After Surgery: A Review. JAMA Surg 2017;152:292-8.
7. Huang J, Cao C, Nelson G, Wilson RD. A Review of Enhanced Recovery After Surgery Principles Used for Scheduled Caesarean Delivery. J Obstet Gynaecol Can 2019;41:1775-88.
8. 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.e1-523.e15.
9. Khoyun S. Effect of post-operative recovery program with the use of easy walk equipment to prevent complications in abdominal surgery patients. Srinagarind Med J 2019;34:386-92.
10. Jovanović G, Jakovljević DK, Lukić-Šarkanović M. Enhanced recovery in surgical intensive care: a review. Front Med (Lausanne) 2018;5:256.
11. Greco M, Capretti G, Beretta L, Gemma M, Pecorelli N, Braga M. Enhanced recovery program in colorectal surgery: a meta-analysis of randomized controlled trials. World J Surg 2014;38:1531-41.
12. 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.
13. 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.
14. Pitimana-aree S, Udompanthurak S, Lapmahapaisan S, Tareerath M, Wangdee A. Validity and reliability of quality of recovery-35 Thai version: a prospective questionnaire-based study. BMC Anesthesiology 2016;16:64.
15. Bowyer A, Jakobsson J, Ljungqvist O, Royse C. A review of the scope and measurement of postoperative quality of recovery. Anaesthesia 2014;69:1266-78.
16. 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.
17. Meng X, Chen K, Yang C, Li H, Wang X. The clinical

efficacy and safety of enhanced recovery after surgery for cesarean section: a systematic review and meta-analysis of randomized controlled trials and observational studies. Front Med (Lausanne) 2021;8:694385.
18. McDaid C, Maund E, Rice S, Wright K, Jenkins B, Woolacott N. Paracetamol and selective and non-selective non-steroidal anti-inflammatory drugs (NSAIDs) for the reduction of morphine-related side effects after major surgery: a systematic review. Health Technol Assess 2010;14:1-153.
19. 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.
20. Pan J, Hei Z, Li L, Zhu D, Hou H, Wu H, et al. The advantage of implementation of enhanced recovery after surgery (ERAS) in acute pain management during elective cesarean delivery: a prospective randomized controlled trial. Ther Clin Risk Manag 2020;16:369-78.
21. Mullman L, Hilden P, Goral J, Gwacham N, Tauro C, Spinola K, et al. Improved outcomes with an enhanced recovery approach to cesarean delivery. Obstet Gynecol 2020;136:685-91.
22. 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.
23. Kleiman AM, Chisholm CA, Dixon AJ, Sariosek BM, Thiele RH, Hedrick TL, et al. Evaluation of the impact of enhanced recovery after surgery protocol implementation on maternal outcomes following elective cesarean delivery. Int J Obstet Anesth 2020;43:39-46.
24. Meng X, Chen K, Yang C, Li H, Wang X. The clinical efficacy and safety of enhanced recovery after surgery for cesarean section: a systematic review and meta-analysis of randomized controlled trials and observational studies. Front Med 2021;8:1-10