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Effect of the implementation of an enhanced recovery after surgery protocol (ERAS) in patients undergoing an elective cesarean section

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ABSTRACT

Objectives: To demonstrate that the application of an enhanced recovery after surgery (ERAS) protocol in elective cesarean sections is associated with reduced hospital stay without increasing maternal complications.

Material and methods: This retrospective, comparative study included patients who underwent an elective cesarean section. The patients were divided into groups: group 1, women who received elements of standardized care according to ERAS guidelines, and group 2, women who did not receive this care.

Results: The study included 295 patients, 139 in group 1 (ERAS) and 156 in group 2. The demographic characteristics were similar. Hospital stay and postoperative pain at 24 and 48 hours were lower in patients in group 1; these differences were statistically significant ($p < 0.001$). The overall complication rate, head pain, surgical wound infection, urinary retention, and readmission were similar in both groups.

Conclusions: The application of an ERAS protocol can reduce hospital stay and postoperative pain without increasing the postoperative complication rate in patients who undergo an elective cesarean section. In developing countries, the application of this protocol could help in optimizing available health system resources.

Key words: ERAS; enhanced recovery; enhanced recovery after surgery; c-section; cesarean section

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INTRODUCTION

A cesarean section is a surgical procedure to deliver a fetus and its membranes through a laparotomy and an incision in the uterus (hysterotomy) [1].

Cesarean section is the most common surgery performed worldwide, and its prevalence has increased, increasing the risks of maternal morbidity, and mortality. It is estimated that approximately 18.5 million cesarean sections are performed each year. The increase in cesarean sections in Mexico has been a motive of concern for the government health system. Between 2000 and 2012, the number of cesarean deliveries increased by 50.3%. There is also a clear difference in the number of cesarean deliveries practiced in the public and private practice (40.9% vs 69.9% of all deliveries, respectively). Mexico has the fourth-highest rate of cesarean deliveries in the world [2, 3].

It is estimated that up to 45% of all cesarean deliveries are electively programmed. This surgical procedure increases hospital stay, and therefore, the cost of medical care compared to vaginal deliveries. The most frequent complications of cesarean delivery are bleeding, intrabdominal organ damage, postsurgical infection, and venous thromboembolism [4].

Enhanced recovery after surgery (ERAS) is a multimodal, multidisciplinary concept based on scientific evidence [5]. These guidelines were designed for patients who undergo different surgical procedures. Improved recovery has as its central philosophy to reduce the harmful effects

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of surgery. This allows a rapid and beneficial postsurgical recovery [6]. The most important aspects of this approach are adequate postoperative nutrition, a reduction in the surgical stress response, minimum use of opioids in postsurgical analgesia, early mobilization, and the application of postoperative care designed and managed by a multidisciplinary team [7].

This study aimed to evaluate the postoperative results after applying enhanced recovery after surgery in a group of patients undergoing elective cesarean section in a tertiary-care private hospital in Monterrey, Nuevo Leon, Mexico.

Objectives

To demonstrate that the application of an enhanced recovery after surgery (ERAS) protocol in elective cesarean sections is associated with reduced hospital stay without increasing maternal complications.

MATERIAL AND METHODS

This was a retrospective, comparative study carried out at the Hospital San Jose of the Tec Salud System of the Instituto Tecnológico y de Estudios Superiores de Monterrey in Monterrey, Mexico. Pregnant women between 18 and 40 years of age with an electively planned cesarean section from January 1, 2017, to December 31, 2020, were included with previous Ethics Committee approval (P000237-AGECE 120-CI-CR002).

Inclusion criteria were women 18 to 40 years of age with a term pregnancy (37 to 41 weeks of gestation) programmed for an elective cesarean section. The exclusion criteria were patients undergoing an emergency cesarean section, women with obstetric hemorrhage, patients with active labor, infection, a hysterotomy other than Kerr, with more than three previous cesarean sections, morbid obesity [body mass index (BMI) > 40 m^2/kg], placentation disorders, a history of hypertension and/or diabetes mellitus, hypertensive disease of pregnancy, and/or gestational diabetes, women with kidney function abnormalities, and patients with platelet and/or coagulation disorders. Patients with incomplete medical records were excluded.

The patients were divided into groups. Group 1, patients undergoing an elective cesarean section during 2020 and who received a series of standardized preoperative, perioperative, and postoperative care according to ERAS guidelines implemented in the hospital, and group 2, patients who underwent an elective cesarean section during 2017 and 2018 before the implementation of ERAS care in the hospital. All procedures from both groups of patients were performed by the same group of surgeons.

The applied standardized procedures consisted of not performing bowel preparation before the procedure, allowing the intake of fluids and carbohydrates up to six hours before surgery, not using pre-anesthetic sedation, thromboprophylaxis with knee compression stockings, a prophylactic antibiotic (cephalothin 2 grams intravenously 30 to 60 minutes before the skin incision; in the case of penicillin allergy, gentamicin 80 mg intravenously), no pubic hair shaving, and a surgical scrub with chlorhexidine.

A Kerr-type hysterotomy was performed, a liquid diet was started early after surgery (4 h), intravenous fluids were administrated for a maximum of 24 hours after surgery, nausea and vomiting were controlled pharmacologically, and postoperative pain control was made paracetamol and ketorolac, opioids were avoided as much as possible. The urinary catheter was removed, and ambulation was started 12 h after surgery. A visual analog scale was used to assess postoperative pain. All the complications observed during the study were reported.

Statistical analysis was performed with the Kolmogorov-Smirnov test to determine the normality of the variables. Categorical variables were reported as frequencies and percentages and continuous variables with a non-normal distribution as medians and ranges. The characteristics of both groups were compared using the Mann-Whitney U test for continuous variables and Pearson's chi-square or Fisher's exact test for categorical variables. All tests were bilateral, considering a p value < 0.05 as statistically significant. SPSS statistical software version 16 was used to analyze the data.

RESULTS

A total of 295 patients were subjected to the surgical procedure. Group 1 included 139 patients who received the previously described care according to ERAS guidelines. Group 2 included 156 patients who had an elective cesarean section but without applying the described standardized procedures.

The women who underwent the ERAS protocol were older (30.5 ± 5.2 vs 29.1 ± 4.8), and this difference was statistically significant ($p = 0.01$). The BMI was similar in both groups (29.9 kg/m^2 vs 30.6 kg/m^2; $p = 0.08$). The marital status of the patients, height and BMI are summarized in Table 1. The gestational age at surgical intervention was similar in both groups (Tab. 1).

All the women included, on both groups, received a Kerr hysterotomy, thromboprophylaxis, and antibiotic prophylaxis. Intravenous fluids with Hartmann's and 5% glucose solutions were provided to all patients. Hartman's solution was administered during the surgical procedure. After delivery, 5% glucose solution and Hartman solution were administered alternately.

Most of the women in both groups received some preoperative sedation (72.3%), an antiemetic (81.2%),

Table 1. Demographic characteristics of the patients

Characteristic	Group 1 (139, 47.2%)	Group 2 (156, 52.9%)	p value
Age [years]	30.5 ± 5.2 (19–44)	29.1 ± 4.8 (18–44)	0.018
Weight [kg]	75.7 ± 12.0 (51–112)	78.3± 11.8 (48–105)	0.037
Height [m]	1.59 ± 6.3 (1.43–1.76)	1.60 ± 5.7 (1.47–1.74)	0.38
BMI [kg/m^2]	29.9 ± 4.2 (18.3–38.7)	30.6 ± 4.8 (20.2–39.5)	0.08
Gestational age [weeks]	38.5 ± 0.85 (37–40.1)	38.5 ± 0.85 (37–41.3)	0.72
Marital status, married, n (%)	136 (87.2)	127 (90.7)	0.48

Data are presented as means ± standard deviation and (ranges) unless otherwise stated; BMI — body mass index

Table 2. Comparison of duration times of interventions in the groups

Intervention	Group 1 n = 139	Group 2 n = 156	p value
Fast [hours]	8.0 ± 1.9 (3–20)	11.3 ± 2.31 (2–24)	< 0.001
Intravenous solutions [hours]	20.7 ± 4.1 (8–24)	19.9 ± 4.3 (12–24)	0.15
Pain scale points [24 hours]	2.8 ± 2.1 (1–10)	4.0 ± 1.3 (1–10)	< 0.001
Pain scale points [48 hours]	2.1 ± 1.2 (1–9)	2.8 ± 1.9 (1–10)	> 0.99
Removal of urinary catheter [hours]	20.1 ± 4.4 (10–55)	22.3 ± 4.6 (12–44)	< 0.001
Start of oral intake [hours]	8.8 ± 2.9 (2–16)	10.5 ± 2.8 (6–20)	< 0.001
Ambulation [hours]	20.2 ± 3.9 (11–22)	22.6 ± 4.1 (12–44)	< 0.001
Postsurgical hospital stay [hours]	44.0 ± 5.4 (31–60)	50.2 ± 8.2 (37–84)	< 0.001

Data are presented as means ± standard deviation and (ranges) unless otherwise stated

Table 3. Comparison of number and type of complications between the two study groups

	Group 1, n = 139	Group 2, n = 156	p value
Complications	3 (2.1)	4 (2.6)	1
Hospital readmission	1 (0.7)	2 (1.3)	1
Surgical wound infection	1 (0.7)	2 (1.3)	1
Head pain	2 (1.4)	2 (1.3)	1
Urinary retention	1 (0.7)	0	0.47

Some patients had more than one complication

and postoperative opioids (84.8%). There was no significant difference between the groups.

Skin antisepsis was performed with chlorhexidine. Body temperature was strictly monitored. These procedures were not performed in group 2 (patients who did not receive the ERAS protocol). The fasting period in group 1 was shorter than in group 2 (8.0 ± 1.9 vs 11.3 ± 2.3 h). This difference was statistically significant ($p < 0.01$). The urinary catheter was removed (20.1 ± 4.4 vs 22.3 ± 4.6 h), and diet (8.8 ± 2.9 vs 10.5 ± 2.8 h) was started sooner in group 1; ambulation also started sooner (20.2 ± 3.9 vs 22.6 ± 4.1 h). These findings were statistically significant ($p < 0.01$) (Tab. 2). According to the visual analog scale, there was less pain at 24 h in group 1 (2.8 ± 2.1 vs 4.0 ± 1.3). This finding was statistically significant ($p < 0.01$); however, the results of postoperative pain at 48 hours were not significant (2.1 ± 1.2 vs 2.8 ± 1.9) (Tab. 2). The women in group 1 had a shorter hospital stay (44 ± 5.4 vs 50 ± 8.2 hours; $p < 0.01$) and also received less antibiotic therapy (80.7% vs 89.1%; $p < 0.05$).

Only seven patients (2.4%) of all the women included in the study had a complication. The complications observed were hospital readmission (3, 1%), surgical wound infection (3, 1%), head pain (4, 1.4%), and urinary retention (1, 0.3%). Patients who had a surgical wound infection were the ones who were readmitted, one of them also showed urinary retention. There was no significant difference between the two groups regarding complications (2.6% vs 2.1%; $p > 0.9$) (Tab. 3).

DISCUSSION

The implementation of the ERAS protocol in women subjected to an elective cesarean section was associated with a reduction in postoperative pain and time of hospital stay. Likewise, patients in this group started a postoperative diet earlier and had the urinary catheter removed sooner, which allowed early postoperative ambulation. These benefits helped speed up the hospital discharge of these patients.

Some studies have reported a shortened hospital stay and a reduction in surgical complications when this protocol is applied, a situation that reduces total costs for the patient [8, 9]. These benefits translate into quality medical care, generating greater security which the patient perceives as a better surgical experience.

In our study, the complication rate was similar in both groups. Therefore, the interventions in the ERAS protocol do not increase the complication rate and offer the possibility of significantly shortening the hospital stay of patients who undergo an elective cesarean section.

Enhanced recovery after surgery is a series of guidelines developed in 2001 by a group of surgeons in Europe with a multidisciplinary approach that focuses on surgical patients [10]. The ERAS protocol involves several elements of care, such as carbohydrate drinks two hours before surgery, early mobilization, and early oral postoperative intake of fluids and food (the same day of surgery) [5, 11].

The care proposed in the ERAs protocol is divided into specific elements. Preoperatively, carbohydrate fluids are recommended at least two hours before surgery to reduce insulin resistance and increase early recovery, prophylaxis against thrombosis, antibiotics as prophylaxis against infection at least 60 minutes before the skin incision, and antiemetics to reduce the possibility of postoperative nausea and vomiting [11]. Whether they were in the ERAS group or not, all women in our study received prophylaxis against thrombosis and infection; there was no difference in the frequency of administration of antiemetics in the two groups ($p = 0.26$).

The ERAS protocol proposes controlling body temperature using thermal blankets and warmed intravenous solutions to reduce complications in the intraoperative period [12]. In our study, body temperature was controlled in 100% of the patients in the ERAS protocol and none in group 2 ($p < 0.001$).

Finally, in the postoperative period, several measures are recommended. First, early mobilization and early oral intake of fluids and solids on the day of surgery to reduce the insulin resistance induced by fasting; early removal of the urinary catheter and intravenous fluids; pain management limiting opioid administration; and preparation for early discharge [13]. In our study, there were no significant differences between the hours of intravenous solution administration ($p = 0.15$). The urinary catheter was removed earlier in women in the ERAS protocol; an early oral diet after surgery and early ambulation also occurred in the ERAS patients. However, the most relevant aspect of our results was undoubtedly the reduction in hospital stay after surgery in the patients in the ERAS group. In any health system, a decrease in the length of hospital stay represents resource savings that allow a greater number of women to be cared for more efficiently.

Some data suggest that the implementation of the ERAS protocol can reduce complications by 10 to 20% [14, 15]. In this study, the number of complications did not differ between the two groups. The sample size seen in the study did not allow a statistical comparison of complication rates.

The ERAS protocol has shown to reduce hospital length stay, in our study the difference was statistically significant between both groups, since the difference was six hours, it may not appear to be clinically relevant for a single patient but applied on public health system on a single hospital in our city that has 4800 cesarean sections per year that is 28,800 less hours.

The ERAS protocol also reduces health costs [16]. For example, a study published by Rhou et al. [17] reported that the costs of patients who underwent laparoscopic hysterectomy with the ERAS protocol were lower than those of patients undergoing the same surgery but who did not follow the ERAS protocol ($p = 0.001$). This data is important. Our population could benefit because Mexico is considered a developing country.

One of the limitations of the present study is the fact that some of the procedures that are part of the ERAS protocol may be similar to the procedures that are conventionally used in clinical practice.

CONCLUSIONS

The application of an ERAS protocol can reduce hospital stay and postoperative pain without increasing the postoperative complication rate in patients who undergo an elective cesarean section. In developing countries, the application of this protocol could help optimize available health system resources.

Ethics

Ethics Committee approval number: P000237-AGECE 120-CI-CR002.

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Conflict of interests

The authors declare that they have no conflicts of interest.

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