Comparison of Post-Operative Outcomes Between Enhanced Recovery After Surgery Versus Standard Operative Protocol Among Cesarean Delivery Mothers at a Tertiary Hospital*

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ABSTRACT

This Randomized Controlled Trial sought to determine whether mothers who underwent Cesarean delivery had better postoperative outcomes when subjected to the Enhanced Recovery After Surgery (ERAS) protocol compared to mothers who also underwent Cesarean section as a mode of delivery but were under the Standard operative protocol.

The research concentrated on evaluating the postoperative outcomes of the patients in the study through the following factors: length of hospitalization, efficiency and cost-effectiveness of hospital expenses, early resumption of diet and early ambulation, breastfeeding initiation and continuation.

A total of 72 subjects were included in the study. Two were not included due to conversion to general anesthesia. Thirty two (44.4%) were randomized to the ERAS protocol while 40 (55.6%) patients were randomized to Standard postoperative procedure. Demographic characteristics were recorded and comparable between the two groups. Mothers randomized to the ERAS protocol had significantly shorter length of stay compared to mothers in the standard operative procedure with a mean of 53.01 hours (2.21 days) and 78.86 hours (3.29 days) respectively. Mothers randomized to the ERAS protocol spent significantly lower hospitalization cost compared to mothers in the standard operative procedure. There was no significant difference noted in the proportion of mothers with fever between the two groups (p=0.25). Mothers randomized to the ERAS protocol had significantly lower post-operative pain compared to mothers in the standard operative procedure. The time from end of OR until general liquids was also significantly shorter among mothers randomized to the ERAS protocol compared to mothers in the standard operative procedure. Similarly, the time from end of OR to flatus and bowel movement was also significantly shorter among mothers randomized to the ERAS protocol compared to mothers in the standard operative procedure. The time from end of OR to removal of foley catheter and time to void after foley catheter removal was also significantly shorter among mothers randomized to the ERAS protocol compared to mothers in the standard operative procedure. Finally, there was a significant difference noted in the length of time from end of OR to breastfeeding as proven by all p value of 0.02. Mothers randomized to the ERAS protocol had significantly shorter length of time from end of OR to breastfeeding compared to mothers in the standard operative procedure with a mean of 30.67 hours and 43.09 hours respectively.

Ultimately, the study concentrated on Emergency or Elective Cesarean deliveries of Low risk patients as well as patients with controlled gestational or overt diabetes mellitus, thyroid disorders in euthyroid state, and hypertensive disorders not complicated with eclampsia. This study did not seek to generalize the benefit of ERAS protocol on all Cesarean deliveries.

ERAS protocol showed better post-operative outcomes compared to the Standard operative protocol in terms of shorter length of hospital confinement, lower cost of hospitalization, no occurrence of post-operative infections and complications, shorter length of time from operation

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to diet progression tolerance, passage of flatus, bowel movement, shorter length of time from end of OR to removal of foley catheter and time to void and finally shorter time from operation to initiation of breastfeeding and continuation.

Keywords: Enhanced Recovery After Surgery, ERAS protocol, Cesarean delivery

INTRODUCTION

Enhanced recovery after surgery (ERAS) is a concept that combines evidence-based aspects of peri-operative care which aims to accelerate patient recovery. It had been developed for patients undergoing colorectal surgery but was adopted by other surgical specialties with similar positive outcomes. [1]

The principles of ERAS protocol involve interventions that span the pre-operative, intraoperative and post-operative periods. It addresses the common reasons why there is delay in patient recovery from surgery and prolonged hospital stay due to inadequate analgesia slow return of bowel function, and delayed ambulation.[1]
According to an article entitled Rising Rate of Cesarean section- A Year-end review, there is a rising trend of Cesarean section in modern obstetrics which is a major concern in the Health Care system all over the world. With all the limited health care resources in developing countries like the Philippines, the national CS rate is now at 22.7%.[3] In addition, the World Health Organization states that no region in the world is justified in having a Cesarean rate greater than 10-15% and this rising trend definitely has major implications.[4]

Financial burden is also a major consideration during childbirth. The cost of Cesarean delivery in over 40 maternity hospitals in Manila ranges from 20,000 to 100,000 (with or without Philhealth coverage)[2] During a five-year period from 2013-2017, Philippine Obstetrical and Gynecological Society Annual Census reported approximately 30% Elective or Emergency Cesarean Section which corresponded to 145,647 Cesarean deliveries from a total of 447,614 deliveries.

Due to the rising trend of Cesarean section rate, the ERAS protocol will serve to address the common reasons that delay recovery of the mother (inadequate analgesia, slow return of bowel function and delayed ambulation) which will shorten the hospital stay and the cost of hospitalization.

The significance of this study is to determine whether women randomized to an enhanced recovery program will have improved post-operative outcomes, including reduction in length of hospital stay, lower hospital bill, early resumption of diet and early ambulation, improved breastfeeding initiation and continuation without compromising the satisfaction of patients compared to the standard postoperative recovery interventions.

If this study will seek to prove whether ERAS protocol is superior than the Standard Operative Care in terms of post-operative outcomes, it will serve as a reference for probable implementation and support of ERAS protocol in all Cesarean deliveries at MCU-FDTMF Hospital and other Hospitals in the Philippines. This research may also promote modifications in the ERAS protocol suited for the needs of each individual Hospital and may be used for further studies.

The ERAS society was founded in 2010 which aims to develop international consensus guidelines and resources for the implementation of ERAS bundles. This consensus outlined techniques to decrease perioperative physiologic stress to reduce perioperative morbidity and mortality, accelerate recovery, and decrease cost of care. [6] This research protocol has been patterned from the guidelines for Antenatal and Pre-operative care in Cesarean Delivery recommendations of the ERAS society.

Enhanced Recovery After Surgery, also known as “Enhanced Recovery Protocols” (ERP) or “Fast-track surgery” is a multidisciplinary approach aimed to enhance recovery and preserve immune function.[5,6] Its effectiveness in reducing hospital stay is well described in literature and mostly in colorectal surgery. No mechanical bowel preparation, no preoperative fasting, early postoperative feeding, avoidance of opiates and avoidance of fluid overload.

In one study, it was demonstrated that there was surgical stress reduction in elderly patients undergoing elective colorectal laparoscopic surgery

in an ERAS protocol. In the postoperative period, ERAS group patients returned faster to a normal bowel function. Passage of flatus and return to a solid meal was evident in the ERAS group (EG) and was statistically significant [5]. First flatus occurred on 1.5 +/- 0.6 versus 2.4 +/- 0.9 days in the Standard group (SG). However, there was no difference between groups for passage of stool. Solid meal was tolerated at day 1.2 +/- 0.8 in EG versus 2.9 +/- 0.3 days in the SG ($p < 0.05$). EG patients could walk at least 100 meters on day 1.6 +/- 0.8 versus 2.0 +/- 0.9 in the SG ($p<0.05$). Day of discharge was 4.7 +/- 1.2 in the EG versus 6 +/- 1.6 days in the SG ($p<0.05$)[5]

Enhanced recovery in obstetrics may be possible and beneficial for women who undergo Cesarean section since the principle of enhanced recovery is to speed up a patient's recovery after surgery and to improve patient outcomes. In a randomized controlled trial published by Chion Tan et al, women discharged on day 1 compared to day 2 following elective cesarean section found no significant difference between the two groups looking at two primary outcomes: maternal satisfaction with discharge date and exclusive breastfeeding rates at six weeks. Maternal satisfaction for women discharged on day 1 was 87.1% compared with 85.5% for women discharged on day 2 (relative risk 1.1, 95% CI 0.6-2.1). A number of factors affect breastfeeding rates and it is well established that cesarean section (elective or emergency) has a negative impact, possibly as a result of the inability to breastfeed comfortably in the delivery room or in the immediate post- partum period. It has also been established that the long-term success of breastfeeding is largely dependent on factors outside the hospital. Therefore, it could be postulated that early discharge may lead to improved breastfeeding rates. However, this was not evident with exclusive breastfeeding rates at six weeks being comparable in both groups: day 1 discharge 44.7% compared with 44.9% on day 2 discharge (relative risk 1.0, 95% CI 0.7-1.5).[12]

There are already many aspects of current routine perioperative care of the patient undergoing a cesarean delivery that are consistent with components of ERAS. A survey of Obstetric anesthesiologists in the UK conducted in 2013 showed that majority of respondents supported the concept of ERAS for cesarean delivery and most were considering or were in the process of implementing ERAS protocol at their institutions.[1]

In a study done by I.J. Wrench entitled "Introduction of Enhanced Recovery for Elective Cesarean Section Enabling Next Day Discharge: A Tertiary Center Experience", they have introduced the ERAS protocol among Cesarean section mothers in Jessop Obstetric Unit, United Kingdom which is a tertiary referral center with approximately 7000 deliveries per annum. A multidisciplinary team was convened to introduce ERAS for elective CS to the unit which included anesthetists, obstetricians, hospital and community midwives, breastfeeding specialists, patient representative, senior neonatal nurse and pharmacist.[10]

Features for planned CS that were already consistent with fast-track surgery included minimal interruption of oral intake, clear fluids up to 2 hours before surgery.[10]

Scientific evidence has shown that intake of clear fluids until 2 hours before surgery does not increase gastric content, reduce gastric fluid pH, or increase complication rates. Hence, in patients without conditions associated with delayed gastric emptying the intake of clear fluids until 2 hours before the induction of anesthesia as well as a six-hours fast for solid food is now recommended. In order to reduce postoperative insulin resistance and associated risks for complications, carbohydrate loading before surgery has been advocated to achieve a metabolically fed state. In the last decade an increasing number of original studies, systematic reviews, and meta-analyses have shown that carbohydrate loading attenuates the increase in insulin resistance related to surgery and hence should be used routinely in major abdominal surgery.[7] The standard anesthetic technique utilized in the study of I.J. Wrench was a subarachnoid block with spinal diamorphine (94% of patients) and postoperative analgesia consisted of regular paracetamol and ibuprofen with liquid oral morphine for breakthrough pain. [10] In conclusion, this study resulted in a substantial rise in the proportion of patients leaving hospital the day after surgery. The proportion of women Discharged on day 1 increased from 1.6% in the first quarter of 2012 to 25.2% in the first quarter of 2014. There was no increase in the postoperative maternal

readmission rate after early discharge. The 30-day readmission rate was 4.4 % for those discharged on Day 1 and 5.6% for day 2. This readmission rate for those leaving after one night's stay was similar to those going home on Day 2, suggesting women were ready to be discharged at the earlier time. [10]

Based on the ERAS society recommendations on gynecologic surgery, the concept of achieving analgesia through the additive or synergistic effects of different types of analgesics is not new. Non-steroidal anti-inflammatory drugs (NSAIDS) have been extensively investigated, both as part of a multi-modal analgesic regime and are effective at reducing pain and opioid consumption and improving patient satisfaction and a combination of NSAID and acetaminophen is more effective than either drug alone.[8]

Management of postoperative nausea and vomiting was at the discretion of anesthetist, and patient mobilization and removal on the morning after surgery remained unchanged. [10] Dexamethasone appears to have analgesic effects, as well as preventing post-operative nausea and vomiting, so it may be useful as part of an enhanced recovery pathway. Intravenous lidocaine is gaining popularity as an analgesic adjunct in abdominal surgery.[8]

Preoperative counseling helps to line expectations about surgical and anesthetic procedures and can diminish fear, fatigue, pain and enhance recovery and early discharge. Education including verbal explanation, leaflets and multimedia information containing description of the procedure and cognitive interventions may improve control of pain, nausea and anxiety after surgery. [7]

In the intraoperative care which incorporates the prophylactic antibiotic, Cesarean delivery increases the danger infection 5 to 250-fold compared to vaginal delivery. There is however conclusive evidence that prophylactic antibiotics should be administered to all or any women undergoing cesarean delivery. Traditionally, prophylactic antibiotics are not being given until cord clamping due to concern of neonatal exposure to antibiotics. There is however conclusive evidence that prophylactic antibiotics be administered within 60 minutes before skin incision to diminish incidence of maternal postpartum infection. [1]

In case of a prolonged operation, severe blood loss and in obese patients the dose should be repeated. And if hair removal is mandatory then hair clipping is preferred rather than shaving. Chlorhexidine-alcohol is chosen than an aqueous povidone-iodine solution for skin cleansing.[7] The current recommendation may be a single dose of a broad spectrum antibiotic. [1]

The goal of intravenous fluid therapy is to sustain normovolemia and reduce flux across the extracellular space. Enhanced recovery protocols and modern surgical techniques decrease the necessity for both total volume and duration of intravenous fluid therapy. While salt and fluid overload within the postoperative period may be major explanation for morbidity, very restrictive fluid regimen also cause increased morbidity and mortality and thus should be avoided in favor of euvolemia.[7] The usefulness of goal-directed fluid therapy has not been investigated within the Cesarean delivery population.[1] However, within the ERAS society guidelines for intraoperative care in Cesarean delivery, the recommendations stated that maintaining adequate uterine perfusion does not only optimize fetal oxygenation but also can prevent acidosis as well as improve delivery of nutrients and eliminate waste products from the uterine myometrium. Perioperative and intraoperative euvolemia are important factors in patient perioperative care and can lead to improved maternal and neonatal outcomes after cesarean delivery.[11]

In an ERAS protocol, a total hourly volume of not greater than 1.2 ml/kg (including drugs, approximately 90 ml/hour for a 75 kg female) if an intravenous fluid must be maintained. Balanced crystalloid solutions are preferred to 0.9% normal saline since there is a cumulative risk of hyperchloremic acidosis. Oliguria as low as 20 cm^3/hour is a normal response to surgery, and the need for further intravenous fluid boluses should be assessed within clinical context. Intravenous fluids should be terminated within 24 hours after surgery. Balanced crystalloid solutions are preferred to 0.9% normal saline. [8]

During anesthesia and major operation there is a high risk of hypothermia due to exposure and impairment of the thermoregulatory response leading to accelerated heat loss. Hypothermia impairs drug metabolism, adversely affects coagulation and increase bleeding, cardiac morbidity and wound infection. Postoperative shivering also increases oxygen consumption at a critical time and may worsen pain. Warming should be continued into the postoperative period to make sure the patient leaves the post anesthetic care unit with a temperature >36 C.[7] A meta-analysis of 13 randomized trials by Sultan et. al reported that active warming in women undergoing elective cesarean delivery under spinal anesthesia reduced the utmost fall in temperature and decreased the incidence of hypothermia and shivering in comparison with controls not actively warmed. Maintaining normothermia can help facilitate early maternal bonding with the newborn.[1] ERAS guidelines of Cesarean delivery states that body temperature should be measured and maintained between 36.5 and 37.5 C after birth, through admission and stabilization.[11]

Pneumatic compression devices are recommended for all women undergoing Cesarean delivery and not already receiving pharmacologic thrombophophylaxis.[1] Pneumatic compression stockings reduce the speed of Venous thromboembolism when compared to observation. In gynecologic oncology patients, the risk reduction is equivalent in comparison to heparin and improved when combined with heparin. Graduated compression stockings decrease the percentage of DVT in hospitalized patients, especially when combined with another method. [8]

A variety of randomized trials on the topic of early feeding (defined as having oral intake of fluids or food within the first 24 hours after surgery) have been performed in gynecologic oncology. The benefits of early feeding include accelerated return of bowel activity, reduced length of stay, with no evidence of greater complication rates related to wound healing, anastomotic leaks or pulmonary complications. It is vital to note that early feeding is associated with a higher rate of nausea, but not vomiting, abdominal distension, or nasogastric tube use. Perioperative use of chewing gum had a positive effect on the incidence of postoperative ileus (36% vs 15%) and length of stay (1-day reduction) in a randomized trial of patients undergoing staging for gynecologic malignancies. [8]

The physiologic study of the digestive tract shows that the stomach and small bowel resume function within eight hours, large bowel activity returns within 48 hours and rectosigmoid function recovers within 72 hours postoperatively. Usually, clinicians withhold post-cesarean women from oral intake for 18-24 hours after surgery or until the presence of hunger, bowel sounds and/or the passing of flatus has been observed. Visceral irritation during Cesarean delivery causes dopamine and serotonin secretion, which stimulates the medullary vomiting center and causes postoperative nausea and/or vomiting.

The study of Nantasupha et. al.,investigated the effect of domperidone as a possible accelerator in gastrointestinal recovery. The main objective in the study was to compare the efficacy of early oral feeding (EOF) and early oral feeding plus domperidone with a standard diet schedule to look at tolerance to regular diet in women who had undergone a cesarean delivery (CD). Group A were given a conventional diet schedule: fasting for 18-24 hours after surgery, then sipping water, consuming a liquid diet, soft diet, and regular diet consecutively. Group B women received early oral feeding: started sipping water at 3-8 hours after surgery, followed by a soft and then a regular diet. Group C was the same as group B, plus three 10 mg doses of oral domperidone before the first three meals. The primary outcome was time to regular diet tolerance. Secondary outcomes indicated and as follows: time to first flatus; time to ambulation out of bed; duration of intravenous fluid infusion; duration of indwelling foley catheter; length of hospitalization; postoperative pain score; patient satisfaction score; breast milk expression and rate of postoperative complications. Outcomes of the study showed overall median time to regular diet tolerance and median length of hospitalization was 36.6 (27.2-51.8) hours and 65 (53.4-69.6) hours respectively. Most of the subjects in the two early oral feeding groups achieved regular diet tolerance within 24 hours postoperatively, especially in group B, while the subjects in the two EOF groups achieved regular diet tolerance within 24 hours postoperatively, especially in group B, while the

women with a conventional diet schedule achieved regular diet tolerance at 48 hours after CD.[9]

An early regular diet within eight hours after surgery has been shown to lead to a shorter time to bowel functions and a faster return to a solid diet. Shorter mean hospitalization stay has also been demonstrated. This study support EOF by showing that mean time to regular diet tolerance and mean time to flatus in both EOF groups were significantly shorter than those of the conventional diet schedule group, indicating an earlier return to normal bowel function. The resulting earlier ambulation and oral food intake led to a shorter urinary catheter indwelling period and intravenous infusion duration, which, in turn, lead to better ambulation. The patients had a faster return to normal daily activities and an accelerated ability to breastfeed. In other words, the EOF groups had better quality of life than the conventional group and recovered more quickly. Median length of hospital stay within the EOF groups was about 9-12 hours less than the conventional diet schedule group, resulting in reduced caregiver workload and reduced hospital costs. Compared to other major operation, during which visceral stimuli aggravate nausea and/or vomiting, visceral manipulation in CD is minimal. Based on our findings and our review, the resulting effects of CD could also be insignificant and EOF can be commenced with less undesired outcomes. [9]

In conclusion, there is no advantage of EOF with domperidone over EOF only. Visceral manipulation in CD may not be to the extent that any benefit would be perceivable from the anti-emetic mechanism of domperidone. Furthermore, multiple mechanisms may be relevant to recovery of postoperative gastrointestinal function, including the degree of autonomic nervous pathway disturbance, amount of inflammatory mediators and cytokines, anesthetic methods, pain control medicine and gut hormones. [9]

One more reason for the choice to use Domperidone was the expected lactation induction effect; however, breast milk expression wasn't statistically different among the study groups. We measured breast milk expression instead of breastfeeding time (as in previous studies), because breast milk expression can be assessed without affecting the well-being of the neonate. Domperidone didn't enhance the return of gastrointestinal function. To facilitate an accelerated return to normal activity and shorten the duration of clinical intervention in postoperative CD women, EOF should be used in routine practice. [9]

In a case control study done by Laronche et al, they concluded that application of Enhanced Recovery pathway (ERP) after cesarean delivery is associated with improved maternal satisfaction and more positive feelings toward the relationship with the newborn. The aim of this prospective, multicenter study was to compare one maternity unit where ERP was not used versus two maternity units where it had been used. ERP was defined as postoperative combination of the subsequent practice patterns: early mobilization within 6-8 hours after surgery (at least sitting in a chair), early drinking and feeding (within 6-8 hours after surgery and generally include drinking during the PACU stay), maintenance of Intravenous infusion for fewer than 24 hours, early urinary catheter withdrawal (withdrawal within the first 12 hours) and early use of oral analgesics (first oral analgesic pills given within the first 24 hours). The first mobilization takes place 12-24 hours after surgery. Drinking is advised during the stay in the PACU and the first light meal is provided 6 hours after surgery. In contrast to the conventional recovery (CR) program the urinary catheter is removed 24 hours after cesarean delivery or later with the venous cannula even later according to the time of return of the first flatus. This study showed that the ERP protocol applied in patients undergoing cesarean delivery is related to greater satisfaction towards the mother and baby relationship. This result is confirmed by the perceived better maternal-neonatal relationship and improved maternal experience of childbirth. The ERP group was more likely to report feeling close and/or to gain a secure contact with the newborn on Day 1 and 3. Also, within the ERP group, patients more often expressed to be “happy” and/or “reassured” on Day 1 and 3, compared to patients in the “conventional recovery” group. Positive or negative emotions expressed by the mothers in both groups are in relationship with the satisfaction that they feel towards the relationship with their babies. Differences between the ERP and CR groups were mainly observed on the first 24 hours after surgery, with results leading to the CR group becoming close to those of the ERP group on Day3. [13]

Postoperative enhanced recovery seems to improve mainly the maternal childbirth experience on the initial 24-48 hours postoperatively. The ERP seems to show that carrying and nursing of the baby was more frequent and less difficult. This difference is perhaps due to the fact that patients within the ERP group are rapidly mobilized and are less constrained by their intravenous infusion and urinary catheter but they also benefited by a faster recovery and oral intake.[13]

GENERAL OBJECTIVE

To determine the postoperative outcomes using ERAS versus standard protocol among post cesarean section deliveries at a tertiary hospital from September 2019 to September 2020

SPECIFIC OBJECTIVES

1. To present the demographic profile of pregnant patients who were admitted at OB Ward.
2. To determine whether there is a significant decrease in the length of hospital confinement between mothers randomized in the ERAS protocol compared to the standard operative procedure
3. To compare the cost of hospitalization between mothers randomized in the ERAS protocol versus the standard operative procedure
4. To compare the number of cases who developed post-operative infections (occurrence of fever, UTI, pneumonia) between mothers randomized in the ERAS protocol versus the standard operative procedure
5. To compare the length of time in hours from operation to breastfeeding initiation and continuation among mothers randomized in the ERAS protocol versus the standard operative procedure

DEFINITION OF TERMS

For the purposes of clarity and uniformity, for this study the following are the definition of each integral term used:

Hospital Expenses – the amount of money spent for expenses solely on Hospitalization will not include miscellaneous expenses such as Diapers, formula milk if used, etc.

Early Resumption of Diet – considered early if diet (which includes even clear liquids and water) was resumed within 30 minutes post-Cesarean section

Early Ambulation – whether the ambulation was initiated within 12 hours post-Cesarean section

Breastfeeding Initiation – first feeding of breastmilk within the first hour of delivery as recommended in the Essential Intrapartum and Newborn Care. However in this study, we will consider breastfeeding initiation from the length of time from transfer to the OB Ward or Room of choice post-cesarean section (not counting the hours of stay in the recovery room) to the first feeding of breastmilk to infant.

Serious and Complex Illness – severe illness which can be life threatening, with a significant degree of impairment or disability which also increases the need for comprehensive care and management (e.g Pulmonary hypertension, cancer, stroke)

Multimodal Intervention – holistic treatment that strives to combine a broad interactive set of systematic strategies and offer particular assessment tactics that enhance diagnosis, and improve treatment outcomes

Normothermia - core temperature between 36.5 and 37.5 degrees Celsius

Multimodal IV therapy – administration of 2 or more drugs that act by different mechanisms for providing analgesia

Aspiration – entry of materials such as food, pharyngeal secretions or stomach contents from the oropharynx or gastrointestinal tract into the larynx, lower respiratory tract, trachea or lungs
Hypertension in pregnancy – Elevated systolic blood pressure =/> 140 and diastolic blood pressure >/= 90 occurring after 20 weeks age of gestation on two occasions at least 4 hours apart

Gestational hypertension – clinical diagnosis defined by the new onset of hypertension (defined as systolic blood pressure ≥140

mmHg and/or diastolic blood pressure ≥90 mmHg) at ≥20 weeks of gestation in the absence of proteinuria or new signs of end-organ dysfunction The blood pressure readings should be documented on at least two occasions at least four hours apart.

Proteinuria - greater than or equal to 300 mg/24 hours urine collection; Protein/creatinine ration>/= 0.3, Dipstick reading of +1 in urinalysis

Preeclampsia - new onset of hypertension and proteinuria or hypertension and significant end-organ dysfunction with or without proteinuria after 20 weeks of gestation in a previously normotensive woman

Preeclampsia with severe features – diagnosed after 20 weeks age of gestation in previously normotensive women who develop: Systolic blood pressure ≥160 mmHg or diastolic blood pressure ≥110 mmHg and proteinuria (with or without signs and symptoms of significant end-organ dysfunction) or Systolic blood pressure ≥140 mmHg or diastolic blood pressure ≥90 mmHg (with or without proteinuria) and one or more of the following signs and symptoms of significant end-organ dysfunction: (New-onset cerebral or visual disturbance, severe persistent right upper quadrant or epigastric pain unresponsive to medication and not accounted for by an alternative diagnosis or serum transaminase concentration ≥2 times upper limit of normal for a specific laboratory, or both, <100,000 platelets/microL, Progressive renal insufficiency (serum creatinine >1.1 mg/dL [97.3 micromol/L]; some guidelines also include doubling of serum creatinine concentration in the absence of other renal disease), and pulmonary edema

Chronic Hypertension – hypertension of any cause that predates pregnancy. BP >/= 140/90 before pregnancy or before 20 weeks age of gestation or both

Superimposed Preeclampsia - worsening baseline hypertension accompanied by new-onset proteinuria or other findings supportive of preeclampsia in a chronic hypertensive patient

Eclampsia – women diagnosed with preeclampsia and have convulsions that cannot be attributed to another cause.

HELLP syndrome - (Hemolysis, Elevated liver enzymes, Low platelets) probably represents a subtype of preeclampsia with severe features in which hemolysis, elevated liver enzymes, and thrombocytopenia are the predominant features, rather than hypertension or central nervous system or renal dysfunction, although the latter do occur.

Hyperthyroidism – Low Thyroid stimulating hormone (TSH) values based on trimester specific ranges: (0.1 mIU/L –first trimester, 0.2 miU/L- second trimester, and 0.3 miU/L – third trimester), and FT3, FT4 are above normal

Hypothyroidism – Increased TSH values based on trimester specific ranges: (2.5 mIU/L –first trimester, 3.0 miU/L- in the second and third trimester), and FT3, FT4 are below normal

Thyroid Storm – Hypermetabolic complication of hyperthyroidism characterized by Hyperpyrexia (temperature of >41 degrees Celsius), cardiovascular compromise (tachycardia out of proportion to the fever, dysrhythmia, cardiac failure), gastrointestinal upset (diarrhea), central nervous system changes (restlessness, nervousness, changed mental states, confusion), and seizures.

Gestational Diabetes Mellitus - if the fasting blood sugar >/= 92 mg/dL or the 2nd hour 75 g post prandial blood glucose >/= 140 mg/dL

Overt Diabetes – if any of the following values are elevated: fasting blood sugar >/= 126 mg/dL, glycosylated hemoglobin (HbA1C >/= 6.5%), random plasma glucose >/= 200 mg/dL or 2nd hour 75 g post prandial glucose >/= 140 mg/dL

Controlled Blood Sugar –capillary blood glucose monitoring maintained at normal levels (fasting glucose level of 95 mg/dL or less, pre-meal values of 100 mg/dL and 2 hour post-prandial of 120 mg/dL or less) During the night, glucose levels should not decrease to less than 60 mg/dL. Mean capillary glucose levels should be maintained at an average of 100 mg/dL with a glycosylated hemoglobin A1C (HbA1C) concentration no higher than 6%.

Pathologic Tracing – baseline fetal heartrate is not < 100 beats per minute, reduced or increased

variability, sinusoidal pattern. No repetitive late or prolonged decelerations for > 30 minutes (or > 20 minute if reduced variability). Decelerations for > 5 minutes.

COVID-19 – Infectious disease caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), a new strain of virus first detected in Wuhan, China in 2019. It is known to target a person's respiratory system. Infected patients may exhibit symptoms such as fever, cough, shortness of breath and in some cases muscle pain and sore throat. Some patients may also be asymptomatic. On March 11, 2020, the World Health Organization (WHO) characterized COVID-19 as a pandemic due to the exponential increase of the number of cases in more than 100 countries.

Level 4 Personal Protective Equipment (PPE) - this includes Coveralls, Surgical cap, N-95 mask, Scrubsuits, Goggles/Face Shield, Double gloves, Dedicated shoes, Shoe covers

Level 3 Personal Protective Equipment (PPE) - this includes cap and goggles or face shield, N-95 mask, gloves, Gown or coveralls

METHODOLOGY

Study Design

This study was a Randomized controlled trial which aimed to determine if Cesarean delivery mothers randomized to ERAS protocol had better postoperative outcomes versus patients randomized to Standard postoperative procedure. This Research protocol was mostly based from the guidelines that ERAS society published for Antenatal and Pre-operative care in Cesarean Delivery Recommendations. Others were patterned from previous ERAS protocols designed for colorectal, gynecologic and other fields of surgical specialty. This research proposal was presented to the Consultant staff of the OB-Gyne and Anesthesia Department of MCU-Hospital to help with the improvement of this paper and made consensus as to the standard dose of Anesthetic (Intrathecal morphine 0.1-0.2 mg/dose) to be used in the ERAS protocol of this research paper.

Setting of the study

The subjects were recruited among patients admitted at MCU Hospital Obstetrics-Gynecology Labor Room and Ward.

Study Population

This study was composed of 72 parturients, irregardless of parity who were admitted under the Department of OB-Gyn, MCU- FDTMF Hospital who underwent either an Elective or Emergency Cesarean Section.

- **Inclusion Criteria**
  - Filipino women, ages 18 to 40 years old
  - Live, singleton/multiple pregnancy, at 37-42 weeks age of gestation
  - Pregnant women complicated by:
    - Hypertension with no evidence of eclampsia, or HELLP syndrome
    - Overt/Gestational Diabetes Mellitus with controlled blood sugar
    - Thyroid disorder in euthyroid state
- **Exclusion Criteria**
  - Patients who are in eclampsia, HELLP syndrome or in thyroid storm
  - Patients with uncontrolled Diabetes mellitus
  - Patients with serious and complex illness such as pulmonary hypertension, chronic renal disease, cancer, history of stroke, heart failure., etc.
  - Cesarean delivery resulting to complications such as post-partum hemorrhage, bladder injury and uterine atony
  - Cesarean delivery under general anesthesia
  - Difficulty in administration of Spinal or epidural anesthesia (more than 2 attempts)
  - Hypersensitivity to NSAIDS
  - Mothers who developed headache, migraine, vertigo, post-cesarean section

- COVID positive patients
- Patients with symptoms of cough, dyspnea, fever, loose bowel movement
- Patients with travel history especially from Wuhan, China for the last 14 days

Withdrawal or Drop-out Criteria

Mothers who changed their minds and decided to refuse to participate at any time of the study

Sample Size

The number of samples collected was computed using a 95% confidence level and 80% power of the study. A sample of at least 72 was computed. A 20% allowance was added to account for drop-outs or withdrawal. 86 subjects (43 each group) were needed to detect a 0.4 days in the length of stay of patients between the ERAS and control group, with an estimated Standard deviation of 0.5 and 1.2 days respectively. The estimated SD was based from the study of Tiouririne (ERAS for Cesarean Delivery: A Propensity Matched Scoring Analysis - 2015)

Where:

Zα = 95% confidence level = 1.96

Zß = power of the study = 80% power of the study = 0.84

SD = Standard Deviation $\frac{(1.2 + 0.5)}{2} = 0.85$

E = Measure of effect = difference in the length of stay between ERAS and Control group = 2.9 – 2.5 = 0.4

$$n = \frac{(1.96 + 0.84)^2 (0.85)^2}{(0.4)^2}$$

$$= \frac{5.6644}{0.16}$$

n = 36 (+ 20% drop out rate)

n= 43 each group

COVID protocol [14]

Patients allowed for admission at the Labor Room/Delivery room complex are the following:

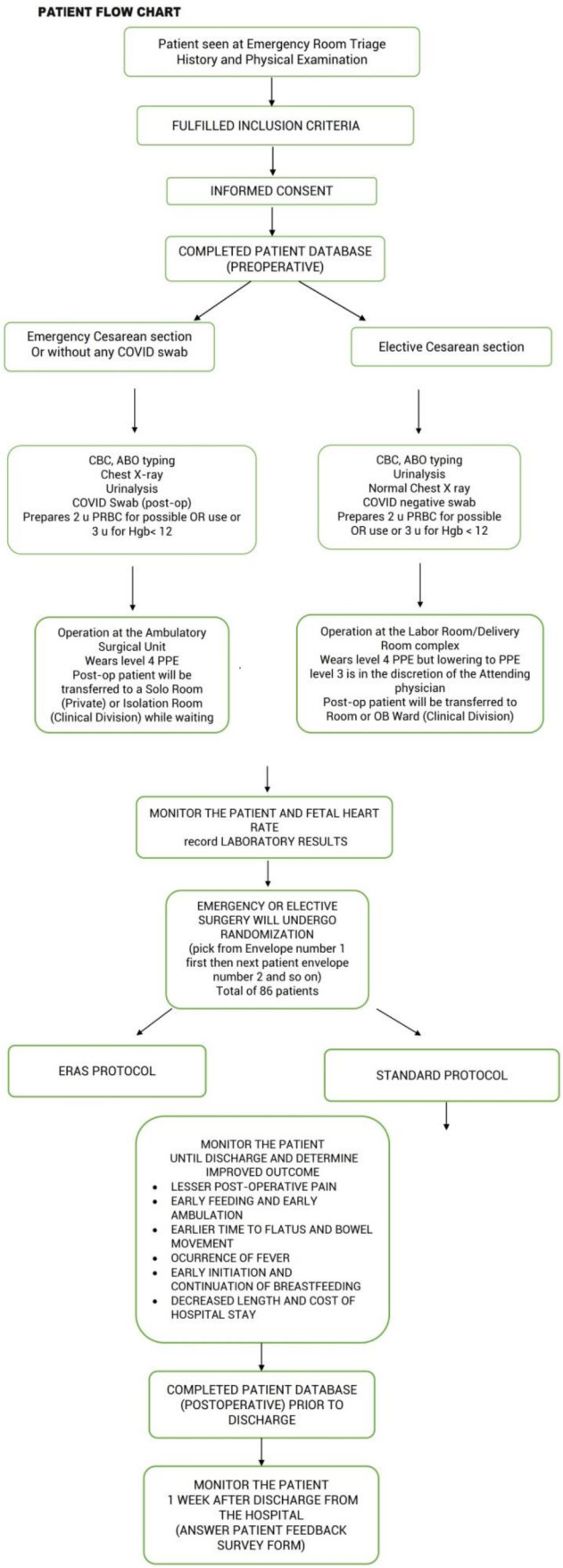
1. Has normal CBC & Urinalysis (Urinalysis can be performed as early as 35 weeks in symptomatic patients to give enough time for treatment prior to term. Otherwise, it can be requested in our hospital as early as 37 weeks) done at our Laboratory Department.
2. Has recent Chest X-ray, PA view with normal official results & performed at our Radiology Department, in COVID (suspect, probable, confirmed) patients.
3. Negative PCR result from DOH accredited laboratory or hospital facility for COVID (previously swabbed due to exposure or with symptoms).
4. Does not fall under the current classification of probable & confirmed COVID cases.
5. Provides 2 units of Packed Red Blood Cell for Hemoglobin level of ≥10 or ≥3 units for levels below 10.
6. Wearing of level 4 PPE despite negative (-) COVID swab result, but lowering the level to PPE 3 is in the discretion of the attending physician.

Septic Deliveries (PPROM/PROM or Probably COVID)

1. Performed at the Ambulatory Surgical unit with the Emergency room OB-Resident physician trainee on duty to assist. These cases will be brought to the Isolation room post partum

Elective Cesarean section or Primary cesarean section will be performed at the Labor Room/Delivery Room complex provided that:

1. Official CBC result is 1 day before the scheduled surgery
2. Official Chest X-ray result 48 hours before the scheduled surgery for patients with symptoms or co-morbidities. This procedure is NOT recommended for patients with RT-PCR COVID negative results, asymptomatic and low risk.
3. Negative COVID swab fourteen (14) days before the scheduled surgery and Strict self-quarantine following the swab test was observed.



The patient's demographic profile was recorded such as: maternal age, status, gestational age, gravidity and parity, BMI, educational attainment, occupation, normal baseline blood pressure in a form of a patient database. Complete history and physical examination were done to the patient at the time of admission to Ambulatory surgical unit (Emergency cases without COVID swab) or Labor room/Delivery Room complex (Elective cases with COVID negative swab). Complete blood count with quantitative platelet count and Urinalysis were sent to the Laboratory. COVID swab for Emergency cases was done post-operatively. The informed consent was well-explained and handed to the patient prior to the Cesarean section.

Sampling Technique: Table Of Random Numbers

The allocation of ERAS or Standard protocol for patients was completely random meaning, in no way was the attribution of whether the patient was to be placed in the study or the control was affected by the patient's profile. Allocation concealment of the treatment groups was done using sequentially numbered, opaque, sealed envelopes. There was a total of 4 envelopes, a third person placed the numbers 1-86 in the 4 different envelopes (Envelopes 1 and 2 contain 21 numbers and Envelopes 3 and 4 contain 22 numbers and each of these numbers either represented ERAS or Standard protocol based on the table of random numbers) in which the researcher had no knowledge of where the numbers were placed in the 4 envelopes. The patient or a representative then picked a number from the four envelopes opened sequentially from 1 to 4. The number picked was the assignment in the treatment groups (ERAS or Standard) based on the table of random numbers using Microsoft excel. Each patient from 1 to 86 was assigned a random number and ranked from lowest to highest.

Patient number	Random Number	A-ERAS B-STD
Patient 85	0.007365604	A
Patient 64	0.020828545	B
Patient 46	0.050396523	A
Patient 7	0.081431375	B
Patient 51	0.100916778	A
Patient 18	0.107874428	B
Patient 70	0.123884924	A

Based on the table of random numbers, Forty three samples with lowest random number assigned was randomized to ERAS then the Forty three samples with highest random number assigned was randomized to Standard protocol.

The researcher had no control on the allocation and pre-determined by a method of using random numbers. However, after the allocation of the patients to facilitate proper interventions, both the patient and the researcher was made aware as to whether they are going to follow the ERAS or the Standard protocol as to ensure compliance from both parties concerned.

20% Drop out rate/withdrawal was allowed for each sample arm (total of 36 patients each arm). This may be attributed to patients who decided to back out anytime from the study due to personal choice or reasons.

Upon discharge the patients were given the contact number of the researcher so that they may report any complications and they were followed up after one week. The patients were given Survey forms in which they completed on the day of follow up.

The duration of participation was from the time of admission to the Labor Room/ASU until one week after Cesarean delivery which was their schedule of follow up. On that day, patient was given or emailed a patient feedback form by the researcher which she answered and submitted back to the researcher either in person or through email. The purpose of the feedback form was to let the researcher know the current state and well-being of the patient.

ERAS PROTOCOL – Enhanced Recovery After Surgery Protocol

This is a single program incorporating multimodal interventions in the peri-operative period to expedite recovery.
Preoperative Period

- Diet: Clear liquids which includes black tea, black coffee, pulp free juice. Milk and soda were not allowed 2 hours prior to Anesthesia. Patient may have 2 slices of white bread 6-8 hours prior to anesthesia
- No Bowel Preparation
- No preoperative sedation
- CBC with QPC and Urinalysis were requested

Intraoperative Period

- Nausea and vomiting prophylaxis: Ondansetron 8 mg/IV 5 minutes prior to induction of anesthesia and Ranitidine 50 mg/IV
- Prophylactic antibiotic: Cefazolin 2 g/IV one hour prior to Cesarean section after negative skin test
- Delayed cord clamping: 1 minute for term, 30 seconds for preterm
- Oxytocin – Given carboprost 1 ampule post delivery, then prophylactic low dose oxytocin infusion (15-18 u/hour) to prevent postpartum hemorrhage
- Venous thromboembolism prophylaxis: Anti-embolic stockings

  Analgesia: Intrathecal morphine 0.1-0.2 mg/dose after negative skin test

Postoperative Period

- Chewed gum to reduce ileus at the Recovery room
- Normothermia- Drop light or Warmer; IV fluids warmed by placing part of the IV in a warm water during infusion; No drop of temperature from baseline (first obtained temperature upon doing physical examination) by a mean of 1.3 degrees Celsius
- Pain: Multimodal IV therapy – (Choice of pain medications upon the discretion of the Anesthesiologist from the following: Morphine, Paracetamol, Ketorolac, Tramadol)
- Early feeding: 30 minutes after procedure may have clear liquids in which they may choose from the following: either black tea,

black coffee or pulp-free juice; if tolerated, may have full diet

- May remove and change dressing 12 hours post-operatively
- Remove foley catheter 12 hours post-operatively
- May mobilize 12 hours after surgery
- Initiate breastfeeding as early as 12 hours
- Given Bisacodyl 1 tablet per orem if still without bowel movement prior to discharge
- Discharge after 24 hours from the time of surgery if without complaints and if with stable vital signs (no BP elevation of >160/110, non-tachycardic > 90 beats per minute, non-tachypneic Respiratory rate >20 counts per minute, afebrile with temperature not =/> 38 C) provided that patient has access to reliable means of communication with Attending physician (private patients) and the researcher to contact them if with concerns.

STANDARD OPERATIVE PROTOCOL (CLINICAL PRACTICE GUIDELINES ON CESAREAN DELIVERY 2012)

Preoperative

- Uncomplicated patient who will undergo elective cesarean delivery may have modest amounts of clear liquids (approx. 1 cup calibrated glass – 210 cc) up to 2 hours before induction of anesthesia.
- Solid foods were avoided in laboring patients. The patient who underwent elective surgery (e.g. scheduled cesarean delivery or postpartum tubal ligation) were fasted for a period of 6-8 hours.
- CBC with QPC and Urinalysis were requested
- An indwelling catheter was inserted prior to doing the Cesarean section

Intraoperative Period

- Aspiration prophylaxis: Before surgical procedures, practitioners considered the timely administration of non-particulate antacids, H2 receptor antagonists, and/or metoclopramide for aspiration prophylaxis
- Regional or Spinal anesthesia was done: the dose and drug was dependent upon the discretion of the anesthesiologist
- Prophylactic antimicrobial agent was given to women undergoing Cesarean section: Either Penicillins or Cephalosporins were the recommended agents. Patient may be given either Cefuroxime 1.5 g/IV or Cefazolin 2 g/IV after negative skin test.

Postoperative Period

- Foley catheter may be removed less than 24 hours after CS.
- Feeding: It was customarily practiced by obstetricians that patients who underwent CS were not allowed to eat or drink until bowel function has returned, as substantiated by the presence of normoactive bowel sounds or passage of flatus. Some argue that there was a high risk of complications from giving oral fluids or food after surgery. Sellers, et al recommended 12-24 hours prior to introduction of fluids. When fluids were well tolerated, bowel sounds were heard and flatus had been passed, should regular diet be commenced. In this research, patients were allowed to drink water after 12 hours or if already with normoactive bowel sounds or passage of flatus. If tolerated, patient were given general liquids (ex. Juice or tea). Then were progressed to soft diet if with flatus then regular diet once with bowel movement.
- IV pain medications and Oral medications was according to the discretion of the anesthesiologist
- Changed the dressing prior to discharge.
- There was no evidence of adverse outcomes associated with early postnatal discharge (three to four days). In this study, patient may be discharged after 48-72 hours or longer.
- Post cesarean delivery mothers were evaluated in terms of lesser degree of the following from the time of Cesarean section:

occurence of fever, post-operative site dehiscence, vomiting, bloatedness, Infections such as UTI, Surgical site infection and pneumonia, lesser degree of post-operative pain and occurence of ileus (time to flatus/bowel movement), faster initiation and continuation of breastfeeding and ultimately shorter and lower cost of hospital stay.

Data Analysis

Data was encoded and tallied in SPSS version 10 for Windows. For numerical data, mean and standard deviation were computed. For nominal data, frequency and percentage were operated.

Data was analyzed using the following test statistics:

T- test (or Mann Whitney U test as needed) was used to compare two groups with numerical data (e.g age of patient, age of gestation, BMI, length of hospital stay, time to initiation of breastfeeding, hospital cost)

Chi-square (or Fisher Exact test as needed for 2x2 table) was used to compare or associate nominal data (e.g. civil status, educational attainment, occupation, post-operative infection

Scope and Limitations

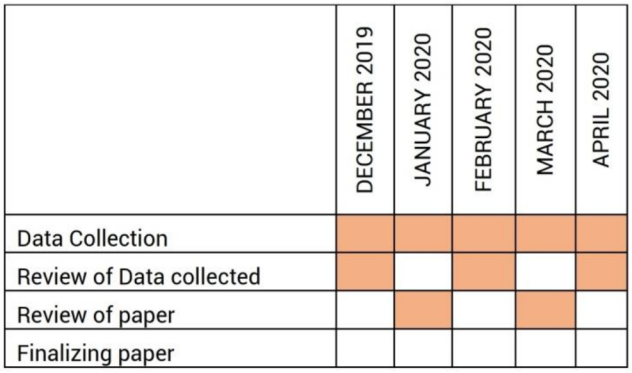
The research paper was conducted primarily to determine if Cesarean delivery patients randomized to ERAS protocol will have better postoperative outcomes versus Standard operative protocol.

As different surgeons employed different skills and techniques and had varying speeds and accuracies, the duration of the procedure and the post-operative outcomes may be affected. This study was not designed to take the underlying effects into consideration.

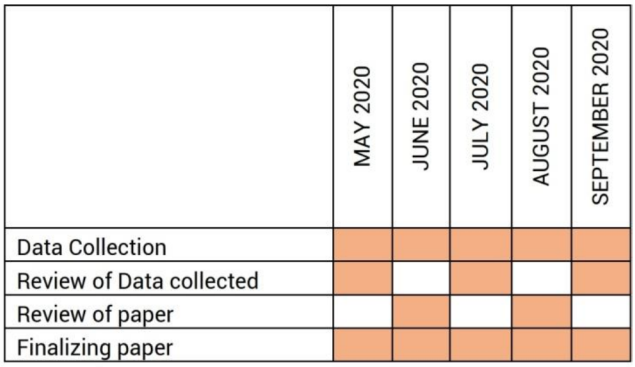
This research study may not have generalized the benefit of ERAS protocol in all Cesarean deliveries since the population was only limited to low risk patients.

GANTT CHART

A. Preliminary report



B. Final report



RESULTS

A total of 72 subjects were included in the study. Thirty two (44.4%) were randomized to the ERAS protocol while 40 (55.6%) patients were randomized to Standard postoperative procedure. Two subjects were not included due to conversion to General anesthesia.

Table 1 shows the comparison of the different demographic characteristics between the two groups. There were no significant differences noted as proven by all p values >0.05. This means that both groups were comparable in terms of the different characteristics indicating that the randomization was properly done.

Table 1. Comparison of the Demographic Characteristics Between the Two Groups

	Groups		p-value*
	ERAS Protocol (n=32)	Standard Protocol (n=40)	
Age (in years)			
Mean ± SD	32.16 ± 5.53	31.25 ± 6.05	0.51 (NS)†
Pay/CD			
CD	12 (37.5%)	11 (27.5%)	0.37 (NS)‡
Pay	20 (62.5%)	29 (72.5%)	
Emergency/Elective			
Elective	6 (18.8%)	2 (5.0%)	0.13 (NS)§
Emergency	26 (81.3%)	38 (95.0%)	
Status			
Married	15 (46.9%)	19 (47.5%)	0.96 (NS)‡
Single	17 (53.1%)	21 (52.5%)	
Educational Attainment			
High School Undergraduate	0	1 (2.5%)	
High School Graduate	7 (21.9%)	6 (15.0%)	
College undergraduate	2 (6.3%)	4 (10.0%)	
College Graduate	22 (68.8%)	27 (67.5%)	0.62 (NS)‡
Doctor	0	1 (2.5%)	
Masters	0	1 (2.5%)	
Vocational	1 (3.1%)	0	
Occupation			
Employed	20 (62.5%)	30 (75.0%)	
Self-employed	8 (25.0%)	10 (25.0%)	0.07 (NS)‡
Housewife	4 (12.5%)	0	

** p>0.05- Not significant; p ≤0.05-Significant*
†T-test; ‡Chi-square test; §Fisher Exact test

Table 1. Comparison of the Demographic Characteristics Between the Two Groups

	Groups		p-value*
	ERAS Protocol (n=32)	Standard Protocol (n=40)	
Monthly Salary (in Pesos)			
<10,000	3 (9.4%)	3 (7.5%)	
10,000 – 20,000	10 (31.3%)	20 (50.0%)	0.40 (NS)‡
20,001 – 50,000	16 (50.0%)	13 (32.5%)	
50,001 – 100,00-	3 (9.4%)	4 (10.0%)	
BMI			
Underweight	0	1 (2.5%)	
Normal	4 (12.5%)	5 (12.5%)	0.68 (NS)‡
Overweight	17 (53.2%)	17 (42.5%)	
Obese	11 (34.4%)	17 (42.5%)	
Gravidity			
Primigravida	10 (31.3%)	18 (45.0%)	
Secundigravida	10 (31.3%)	11 (27.5%)	0.47 (NS)‡
Multigravida	12 (37.5%)	11 (27.5%)	
Parity			
Primipara	12 (37.5%)	19 (47.5%)	0.39 (NS)‡
Multipara	20 (62.5%)	21 (52.5%)	
Age of Gestation (in weeks)			
Mean ± SD (Median)	38.71 ± 0.88 (38.57)	38.41 ± 2.31 (38.86)	0.77 (NS)‖
Comorbidities			
Yes	21 (65.6%)	28 (70.0%)	0.69 (NS)‡
No	11 (34.4%)	12 (30.0%)	
Apgar Score at 1 minute			
Mean ± SD (Median)	8.63 ± 0.66 (9)	8.39 ± 1.18 (9)	0.67 (NS)‖
Apgar Score at 5 minutes			
Mean ± SD (Median)	8.90 ± 0.29 (9)	8.82 ± 0.51 (9)	0.61 (NS)‖
Birthweight (grams)			
Mean ± SD (Median)	3210.94 ± 325.46 (3250)	3123.75 ± 602.66 (3250)	0.91 (NS)‖
Ballard Score (weeks)			
Mean ± SD (Median)	38.47 ± 0.76 (38)	38.58 ± 2.29 (39)	0.12 (NS)‖

Table 2 shows the comparison of the length of hospital confinement from admission to discharge between mothers randomized in the ERAS protocol compared to the standard operative procedure. There was a significant difference noted as proven by the p value of <0.0001. Mothers randomized to the ERAS protocol had significantly shorter length of stay compared to mothers in the standard operative procedure with a mean of 53.01 hours (2.21 days) and 78.86 hours (3.29 days) respectively.

Table 2. Comparison of the Length of Hospital Stay Between the Two Groups

	Groups		p-value*
	ERAS Protocol (n=32)	Standard Protocol (n=40)	
Length of Stay from Admission to Discharge (in hours)			
Mean ± SD	53.01 ± 14.54	78.86 ± 32.30	<0.0001 (S)‖
Median	48.40	72.52	

** p>0.05- Not significant; p ≤0.05-Significant*
‖Mann Whitney U test

Table 3 shows the comparison of the cost of hospitalization between mothers randomized in the ERAS protocol compared to the standard operative procedure. There was a significant difference noted as proven by the p value of <0.0001. Mothers randomized to the ERAS protocol spent significantly lower hospitalization cost compared to mothers in the standard operative procedure with a mean of 36,902.22 pesos and 60,685.48 pesos respectively showing that the cost of hospitalization of mothers in the standard operative procedure was almost twice higher than the cost of hospitalization of mothers in the ERAS protocol group.

Table 3. Comparison of Cost of Hospitalization Between the Two Groups

	Groups		p-value*
	ERAS Protocol (n=32)	Standard Protocol (n=40)	
Cost of Hospitalization (in pesos)			
Mean ± SD	36,902.22 ± 11,441.77	60,685.48 ± 20,738.01	<0.0001 (S)‖
Median	38,703.50	58,740.00	

** p>0.05- Not significant; p ≤0.05-Significant*
‖Mann Whitney U test

Table 4 shows the comparison of the post-operative infections between mothers randomized in the ERAS protocol compared to the standard operative procedure. There was no significant difference noted in the proportion of mothers with fever between the two groups (p=0.25). However, there

was a significant difference noted in the post-operative pain as proven by the p values 0.001. Mothers randomized to the ERAS protocol had significantly lower post-operative pain compared to mothers in the standard operative procedure with a mean of 3.96 and 5.63 respectively for the post-operative pain.

Table 4. Comparison of the Post-operative Infections Between the Two Groups

	Groups		p-value*
	ERAS Protocol (n=32)	Standard Protocol (n=40)	
Fever			
(+)	0	3 (7.5%)	0.25 (NS)§
(-)	32 (100%)	37 (92.5%)	
Post-operative Pain			
Mean ± SD	3.96 ± 1.98	5.63 ± 2.20	0.001 (S)†

** p>0.05- Not significant; p ≤0.05-Significant*
†T-test; §Fisher Exact test

Table 5 shows the comparison of the length of time in hours from operation to breastfeeding initiation between mothers randomized in the ERAS protocol compared to the standard operative procedure. There were significant differences noted in the length of times as proven by all p values <0.05. Mothers randomized to the ERAS protocol had significantly shorter times compared to mothers in the standard operative procedure with a mean of 4.55 hours and 11.61 hours respectively for the time from NPO to start of the OR. The duration of OR was significantly shorter among mothers randomized to the ERAS protocol compared to mothers in the standard operative procedure with a mean of 1.64 hours and 1.88 hours respectively. The time from OR until general liquids was also significantly shorter among mothers randomized to the ERAS protocol compared to mothers in the standard operative procedure with a mean of 4.99 hours and 9.33 hours respectively. Similarly, the time from OR to flatus was also significantly shorter among mothers randomized to the ERAS protocol compared to mothers in the standard operative procedure with a mean of 12.17 hours and 17.47 hours respectively. Also, the time from OR to bowel movement was also significantly shorter among mothers randomized to the ERAS protocol compared to mothers in the standard operative procedure with a mean of 22.86 hours and 35.56 hours respectively. The time from OR to removal of foley catheter was also significantly shorter among mothers randomized to the ERAS protocol compared to mothers in the standard operative procedure with a mean of 11.52 hours and 21.29 hours respectively and the time from removal of catheter to voiding with a mean of 2.20 hours and 5.28 hours respectively. Finally, there was a significant difference noted in the length of time from OR to breastfeeding as proven by all p value of 0.02. Mothers randomized to the ERAS protocol had significantly shorter times compared to mothers in the standard operative procedure with a mean of 30.67 hours and 43.09 hours respectively.

Table 5. Comparison of the Length of Time in Hours from Operation to Breastfeeding Initiation and Continuation Among Mothers in the ERAS protocol Versus the Standard Operative Procedure

	Groups		p-value*
	ERAS Protocol (n=32)	Standard Protocol (n=40)	
Time from NPO to Start of OR (in hours)			
Mean ± SD	4.55 ± 1.75	11.61 ± 4.88	<0.0001 (S)‖
Median	4.33	10.31	
Duration of OR (in hours)			
Mean ± SD	1.64 ± 0.42	1.88 ± 0.50	0.03 (S)†
Time from OR until general liquids			
Mean ± SD	4.99 ± 1.64	9.33 ± 2.59	<0.0001 (S)‖
Median	4.52	8.66	
Time from OR to flatus (in hours)			
Mean ± SD	12.17 ± 5.35	17.47 ± 9.49	0.03 (S)‖
Median	11.83	15.38	
Time from OR to Bowel Movement			
Mean ± SD	22.86 ± 8.81	35.56 ± 12.08	<0.0001 (S)†
Time from OR to removal of foley catheter (in hours)			
Mean ± SD	11.52 ± 2.76	21.29 ± 8.62	<0.0001 (S)‖
Median	11.28	21.75	
Time from removal of catheter to voiding (in hours)			
Mean ± SD	2.20 ± 1.51	5.28 ± 5.06	0.03 (S)‖
Median	1.69	3.00	
Time from OR to breastfeeding (in hours)			
Mean ± SD	30.67 ± 13.85	43.09 ± 21.97	0.02 (S)‖
Median	31.46	37.00	

** p>0.05- Not significant; p ≤0.05-Significant*
†T-test; ‖Mann Whitney U test

Table 6 shows the comparison of the post-operative variables (One week post discharge) between mothers randomized in the ERAS protocol compared to the standard operative procedure. There was a significant difference noted in the pain scale between the two groups (p=0.008). The pain scale of mothers in the ERAS group was significantly lower than mothers in the standard protocol group. However, length of stay and hospital charge were significantly higher among mothers in ERAS group as proven by the p values <0.001.

Mothers randomized to the ERAS protocol had significantly higher number of breastfeeding done on their baby (p=0.001) compared to mothers in the standard operative procedure.

Table 6. Comparison of the Post-operative Variables Between the Two Groups

	Groups		p-value*
	ERAS Protocol (n=32)	Standard Protocol (n=40)	
Pain Scale			
Mean ± SD	2.29 ± 1.71	3.57 ± 2.05	0.008 (S)†
Length of Stay			
Mean	4.19 ± 0.65	3.51 ± 0.85	<0.001 (S)†
Hospital Charge			
Mean ± SD	3.74 ± 0.51	2.91 ± 0.98	<0.001 (S)‖
Median	4.0	3.0	
Breastfeed Baby			
1x – 3x	2 (6.3%)	11 (27.5%)	
4x – 7x	10 (31.3%)	19 (47.5%)	0.003 (S)‡
>7x	20 (62.5%)	10 (25.0%)	

** p>0.05- Not significant; p ≤0.05-Significant*
†T-test; ‖Mann Whitney U test; ‡chi-square test

DISCUSSION

Cesarean section is one of the most significant procedures done and perfected by an OB-gynecologist specialist. There is a rising trend of Cesarean delivery rates which is currently at 22.7% in the Philippines and 21% worldwide which is high compared to the established rate of only 10-15% by the World Health Organization. It is therefore vital to consider the effect of this rising trend with regards to the pre-operative preparations, post-operative pain, breastfeeding, especially the length of stay and the costs to the Filipino mothers who will undergo Cesarean delivery.

Enhanced recovery after surgery is a concept initially developed for patients undergoing colorectal surgery but has been adopted by other surgical specialties with similar positive outcomes. The adoption of the ERAS protocol in obstetric population is gaining popularity especially in the US, Canada and the UK.

There has been no local studies published yet on the ERAS protocol application among Cesarean delivery mothers hence, the researcher adopted the ERAS protocols that were utilized by the UK and US and applied it to the local setting and in this case, the MCU-FDTMF Hospital which is a tertiary center in the Philippines.

This COVID pandemic also contributed to the added burden of the Filipino mothers in terms of the difficulty in having prenatal check-ups leading to unaddressed comorbidities (e.g. uncontrolled hypertension, diabetes mellitus and preterm delivery) due to the lockdown and has resulted into economic instability which brought unemployment and decreased income. This research will also help improve the length of exposure of patients in the hospital and decrease the cost hospital bills if they could be discharged earlier than the usual standard.

In this research, a total of 72 subjects were included 32 (44.4%) and 40 (55.65%) were randomized to ERAS and Standard protocols respectively. Two subjects were not included since they were converted to General anesthesia. There was no significant difference noted in the demographic profile of patients in terms of the following: Age, Pay/CD, Emergency/Elective, Marital status, Educational attainment, Occupation, Monthly salary, BMI, Gravidity, Parity, Age of gestation, birthweight, APGAR SCORE, Ballard score opon delivery and finally Comorbidities between the two groups as seen in Table 1, indicating that the randomization was done and properly achieved.

ERAS protocol spans the multimodal approach in the pre-operative, intraoperative and post-oparative clinical pathway of Cesarean delivery. In the pre-operative pathway, ERAS protocol diet consists of clear liquids (black tea, black coffee, pulp free juice) and a minimum of 2 hours NPO, 2 slices of white bread 6-8 hours prior to anesthesia maybe initiated however, most of the cases were Emergency Cesarean section hence the 2 hours were not strictly followed but with a mean of only 4.55 hours in the ERAS protocol but was significantly shorter as compared to 11.61 hours in the standard protocol. This implies that if we could safely shorten the time of NPO in ERAS and not develop complications such as aspiration, vomiting, and abdominal discomfort as shown in the ERAS study subjects, it would therefore be very much favorable for the patient since it will reduce their thirst and hunger which contributes more to the pain of labor and Cesarean delivery.

For the intra-operative period, the modes of anesthesia were either Spinal or Epidural and mostly the prophylactic antibiotics used were Cefazolin, Cefuroxime and Ampicillin. Factors that would affect the duration of Cesarean section could possibly be the skill of the surgeon and the complexity of the procedure. Surprisingly, the duration of OR was also significantly shorter among mothers randomized to the ERAS protocol compared to mothers in the standard operative procedure with a mean of 1.64 and 1.88 hours respectively.

Post operatively, there were 3 mothers who developed fever with (Tmax of 38.9 degrees Celsius) under the standard protocol, 2 of them received blood transfusion with 2 units PRBC properly typed and crossmatched. None developed fever under the ERAS protocol however no significant difference in between the 2 groups.

The husband or relatives of the patients under ERAS arm were instructed prior to the OR to have the gum and water available post-operative so that they could readily chew the gum and may sip water at the Recovery room as soon as they wake up from anesthesia. None of them vomited nor developed abdominal pain or discomfort. The time to general liquids were also significantly shorter with a mean of 4.99 and 9.33 hours respectively. Early feeding is defined variably as feeding regular diet as early as 30 minutes and up to 8 hours after cesarean delivery contrary to progressive feeding wherein it is started when there is already normoactive bowel sounds and passage of flatus. This research demonstrated a reduction in thirst and hunger and improved maternal satisfaction and ambulation with no evidence of development of complications related to wound healing or infection. Early refeeding is also beneficial since the mother is expected to increase nutrient and caloric intake since she is expected to be breastfeeding her baby.

Similarly the time from OR to flatus and bowel movement were also significantly shorter among mothers randomized to ERAS protocol compared to standard operative procedure with a mean of 12.17 hours vs. 17.47 (flatus) and 22.86 and 35.56 hours (bowel movement) respectively.

In the ERAS arm, the catheter was removed at 12 hours or earlier with a mean of 11.52 hours as compared to the standard operative protocol of 21.29 hours where it was only removed when the patient achieved an adequate urine output >30 cc/hour. However, this study showed significant time from removal of catheter to voiding with a mean of 2.20 hours and 5.28 hours respectively. In a non-randomized clinical trial with 344 patients, Senanayake demonstrated that there was low incidence of postoperative urinary retention after cesarean delivery in patients without an indwelling urinary catheter.[15] Even the prospective study of Nasr in 420 patients randomly assigned to a non-catheterized versus 12 hours removal showed that the mean time to patient ambulation, first postoperative voiding, oral rehydration, bowel movement, and length of hospital stay were significantly less in than noncatheterized group. [15] This may conclude that in women who do not need ongoing strict assessment of urine output, the urinary catheter should be removed immediately after cesarean delivery if placed. This could also shorten the time to ambulation probably leading to earlier bowel movement and breastfeeding.

Based on the Visual Acuity Scoring (VAS), there was significantly lower pain under the ERAS protocol with a mean of 3.96 versus 5.63 over 10 under Standard operative protocol. There was a significant difference noted in the length of time from OR to breastfeeding randomized to the ERAS protocol which was 30.67 versus 43.09 hours respectively. The babies were all delivered term with a mean of 38 weeks and even though some mothers had UTI antenatally wherein their baby was admitted longer in the NICU for antibiotic therapy, this probably did not affect the time to breastfeeding since they could easily breastfeed their babies in the NICU.

Notably, the length of stay was significantly shorter in the ERAS arm which was 53 +/- 14 hours versus 78.86 +/- 32 hours in the standard arm.

Lastly, the cost of hospital stay from the time of admission to discharge was obtained from the Billing section. Professional fees of Private patients and Philhealth deductions were not included in both study arms hence the costs were most likely comparable in between the PAY and CD

patients. However, this study has shown that the costs were significantly different wherein the patients under the standard protocol paid twice as much with a mean of Php 60,685 +/- 20,738.01 compared to only Php 36,902.22 +/- 11,441.77 in the ERAS protocol.

One week after hospital discharge, the patients were given a Satisfaction survey form which they answered either during follow-up at the OPD or through email and messenger. It has four questions namely the pain scale, length of stay, hospital bills and the number of times she was able to breastfeed the baby per day. The satisfaction survey also favored the ERAS protocol than the standard operative protocol wherein all of the 4 parameters showed significant difference as shown in Table 6 of the results.

CONCLUSION AND RECOMMENDATIONS

Enhanced Recovery After Surgery protocol in Cesarean delivery allowed the mother to experience decrease in physiological stress, thirst and hunger thus enabled them to recover more quickly, pass flatus, defecate, ambulate and breastfeed earlier. It decreased significantly the length of stay and resume routine activities more quickly than with standard surgical care. It also simultaneously improved patient satisfaction and their quality of life. More importantly during this COVID pandemic, not only did it shorten hospital exposure but decreased the cost of hospital bills twice as much as the Standard operative protocol.

The pre-operative, intraoperative and post-operative elements of ERAS pathways will continue to evolve as new evidence emerges. There is wide variability in the strength of evidences in the components of the previously published ERAS protocols for Cesarean delivery. Future studies on developing and evaluating the impact of various components are needed.

Further research may be done with regards to not placing a urinary catheter in patients undergoing Cesarean delivery who have normal kidney function and where urine output measurement is not necessary.

Since the researcher only considered post-operative monitoring after one week, further studies might include possible number of post-operative readmissions due to complications in ERAS versus Standard operative protocol.

This research consisted only of Cesarean delivery mothers with controlled Hypertension, Diabetes and thyroid disease as the population hence, another study is suggested to be done on patients who have uncontrolled co-morbidities to formulate and improve the ERAS protocol

This pioneer study yielded good and significant results hence, more study subjects are recommended and may serve as a benchmark for further investigative studies to address existing knowledge gaps and can be replicated in other tertiary institutions most especially in the Government hospitals who cater to deprived and underprivileged patients.

Successful implementation of an ERAS program requires a multidisciplinary team effort as well as the active participation of the Obstetrician, Anesthesiologist and the patient. As Clinicians and Researchers, we are required to be periodically updated and very adaptive to the changing times. We must all be receptive to transformation, paradigm shifts and be knowledgeable as to how to impact our patients to deeply understand each new concept, accept, and adhere to modern modifications necessary to a better superior practice of Obstetrics and in this case formulate new ways to improve on the ERAS protocol in Cesarean delivery.

Initiation of an ERAS Clinical pathway in a timely, cost-effective manner can be logistically challenging hence the practice of the elements of the ERAS protocol can take years to occur but it is the hope of the Researcher that the ERAS protocol will already be considered the new standard in Cesarean delivery practice in the Philippines in the near future and even be applicable worldwide.

ETHICAL CONSIDERATIONS

The researcher adhered to the Ethical principles of Autonomy, Non-maleficence and Beneficence. All the Elective or Emergency Cesarean sections to be performed were with medical

indications and deemed necessary. The Clinical Practice Guidelines on Cesarean Section published by the Philippine Obstetrical and Gynecological Society last November 2012 was the basis for the Standard Operative Protocol while the ERAS protocol was patterned from several previous researches done mentioned in the review of related literature which has also been approved by Ethical review board.

I. Conflict of Interest

The researcher declared no conflict of interest as she conducted this investigation.

II. Privacy and Confidentiality

In order to protect the integrity of the subjects, the researcher did not disclose any personal information (names, home addresses, etc.). When not in use, the written questionnaires, survey forms were kept in a locked file cabinet to be accessed only by the researcher. The confidentiality was strictly kept by the researcher and data was de-identified by substituting the participant's name to participant's number instead.

The researcher stated in the informed consent that the use of private data collected were necessary to conduct the study and was used solely for the purpose of research.

Data encoding was done with the use of a password-protected laptop owned by the researcher in which she solely had access to. At the end of the study, all the Data sheets and survey questionnaires were disposed by the researcher herself through paper shredding.

III. Informed Consent and Recruitment Process

The informed consent contained the nature and purpose of the study in which they were randomized either to ERAS or Standard protocol in Cesarean section and determined the difference in post-operative outcomes in terms of: length of hospital stay, hospital expenses, occurrence of fever etc. The content of the informed consent were thoroughly explained by the researcher. If it was an elective procedure, the informed consent was given at the OPD during her prenatal check-up at least a week prior to the Cesarean section. If it was an emergency procedure, the informed consent was explained verbally at least an hour prior to the procedure. The patient's participation in the trial was voluntary and she may refuse to participate or withdraw from the trial at any time, without penalty. The patients were given the contact number of the researcher and attending physician for which answers to any questions about the research may be addressed and informed if the patient experienced any complications post-operatively.

Lastly, it is important to note that all the Consent forms of the participants; data privacy and the study protocol have passed the technical review and the review of the Institutional Review Board (IRB).

IV. Risk and Benefits

The patients were well-explained that they will undergo Cesarean section which is a major operation which might have risks like surgical site infection, postpartum hemorrhage, adverse reaction to the anesthesia, antibiotics and the pain medications, scar or keloid formation after the surgery.

Measures were done to mitigate these risks by doing a thorough and accurate history taking and physical examination. The intravenous Cefazolin, Cefuroxime, Tramadol, Paracetamol and Ketorolac were only administered to the patient when the skin test was negative. Post-operatively the patient's vital signs were closely monitored for BP elevations, tachycardia, tachypnea, or fever. The patients were given the researcher's contact number to call in cases of complications post-operatively and they were instructed to follow up after 1 week from discharge.

Directly the patient benefited from the study since the Cesarean section was clinically an indicated procedure. Once the data is generated and analyzed and would prove that the ERAS protocol is superior than the standard operative procedure, this will possibly promote the implementation of ERAS protocol in all cesarean deliveries and improve the standard of care among patients undergoing Cesarean deliveries in the future. The patient will be able to ambulate and breastfeed earlier and be

discharged a day after the operation. She will have the privilege to be able to rest and be given the full support of the family including other relatives at the comforts of her own home instead of being visited in the hospital after a major operation.

V. Vulnerability

Vulnerable subjects which include members of a group with hierarchical structure (e.g armed forces personnel, staff and students of medical, nursing and pharmacy academic institution), patients with incurable diseases, refugees were not included in the study. Unemployed and impoverished patients with low educational background were included in the study provided that the researcher made sure that simple language and the Filipino version of the informed consent was thoroughly explained to the subjects who are educationally deprived.

VI. Assent

Minors (below 19 years old) had either parent to give their consent and were made to understand the nature, risks and purpose of the study. Once the minor and either parent fully comprehend the study, they were asked to sign the consent form before the Cesarean delivery.

VII. Compensation and Incentives

The researcher did not give any monetary benefits nor financial assistance to subjects who participated in this research. The researcher did not solicit any financial assistance from companies nor pharmaceutical and/or medical organizations deemed to benefit from the results of the study.

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