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Improving Obstetrical Outcomes in Cesarean Sections, by Utilizing Evidence-Based Strategies

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Abstract

Cesarean sections are the most commonly performed surgery in the USA. Changing policies and clinical information have resulted in improved outcomes for both mothers and babies. We describe evidence-based best practices for a multi-strategy approach to reduce cesarean section rates, increasing safety and success of vaginal births after cesarean section, decreasing complication rates in higher order cesarean sections, and accurate estimations of blood loss. In addition, we present a novel approach of utilizing venous lactate levels to identify the need for blood transfusions in the resuscitation of women with postpartum hemorrhage. Given that pregnancy is a life event, we describe increased self-reported stress levels in women during pregnancy and after the birth. In summary, adoption of the best practices outlined herein will greatly enhance the safe practice of cesarean sections.

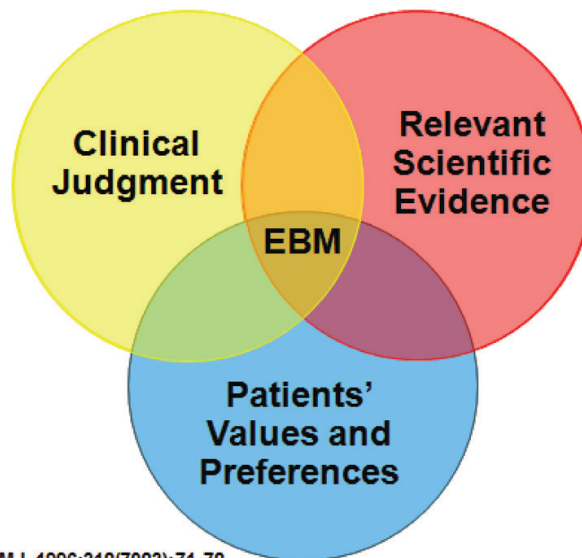
Keywords: evidence based, best practices, cesarean section

1. Introduction

Cesarean sections are the most commonly performed surgical procedures in the USA, and account for approximately one-third of the 4 million annual live births. Cesarean sections can cause significant complications, disability or death, particularly in settings which lack the facilities to conduct safe surgeries or treat potential complications. Due to their increased cost, high rates of unnecessary cesarean sections can pull resources away from other services in overloaded and weak health systems.

The World Health Organization (WHO) recommends that medical practitioners should not undertake cesarean sections purely to meet a given target or rate, but rather focus on the needs of patients.

What Is Evidence-Based Medicine?



Sackett DL, et al. *BMJ*. 1996;312(7023):71-72.

Figure 1. Evidence-based medicine (EBM).

Improved understanding of cesarean section rates has been hindered by the lack of a consistent, internationally accepted classification system to monitor, and compare cesarean section rates. To address this lack, WHO proposes the adoption of the Robson classification system, which can facilitate the comparison and analysis of cesarean rates within and between different facilities, and across countries and regions.

The World Health Organization (WHO) suggested rate is 10–15% [1], and the Healthy People 2020 recommends that the annual rate should decrease in low risk women with a singleton, term live born fetus with vertex presentation (STLV), from the current rate of 27–24% [2]. However, the US rate is much higher, being approximately 32% [3].

Utilizing evidence-based, best practices for the management of patients undergoing cesarean sections has contributed greatly to the improved outcomes in these clinical settings. This approach allows combining a patient's values and beliefs and the clinician's best judgments in addition to the relevant scientific evidence (**Figure 1**).

In this chapter, we outline several evidence-based best practices regarding the management of women who are undergoing cesarean sections so that they may have minimal morbidity and the safest outcomes possible.

2. Current cesarean section practices

Over the past several decades, clinicians have followed the progress of labor based upon the information that had been collected mainly from primiparous females who were undergoing labor with a singleton fetus at term. This information was compiled into the now ubiquitous Friedman Curve and patients were delivered by cesarean delivery if their labor progress did not

follow the trajectory of the Friedman Curve. New evidence suggests that this method of tracking labor progress is no longer appropriate and applicable to contemporary labor practices. In their observational review entitled, Consortium on Safe Labor, Zhang et al. [4] presented the outcomes of 228,668 women, having 233,844 newborns, who were delivered at 12 US Clinical Centers. These included 19 hospitals of which 8 were University Teaching, 9 were Community Teaching, and 2 were Community non-Teaching. All had EMRs. The review encompassed 2002–2008. The overall C section rate was 30.5%, which matched the National rate. Of these, 31.2% were nulliparas, 30.9% were women undergoing scheduled repeat C sections. The Trial of Labor after C Section (TOLAC) rate was 28.8%, and of these, the Vaginal Birth after Cesarean (VBAC) rate was 57.1%. Induction of labor was the admission diagnosis in 43.8% of the women and the pre-operative diagnosis was Dystocia (≤ 6 cm dilation), in 50% of the patients. The investigators also found that many parturients did not have a clear pattern which would indicate an active phase of labor and that this phase likely did not commence until after the cervix was dilated to at least 6 cm, versus the previous beliefs of active phase of labor commencing at 4 cm dilation of the cervix. The total duration of labor was found to be longer than previously thought. Several factors were found to affect the overall progress and therefore the likelihood of a successful vaginal delivery. These included maternal obesity, medical conditions such as diabetes and hypertension, timing and dosage of epidural analgesia. Thus, this information helped to define the current practices of labor management and how best to manage labor in various patients with and without medical and other confounding complications.

2.1. Reducing the C section rate

While the ideal rate for C sections cannot be easily determined, several opportunities to safely decrease the rate currently exist. In the Executive Summary of the WHO Statement on Cesarean Section rates [1], the experts have stated that when medically justified, a C section can effectively prevent maternal and perinatal mortality and morbidity. However, there is no evidence showing the benefits of a C section for women or infants who do not require the procedure. They state that at population level, C section rates higher than 10–15% are not associated with reductions in maternal and neonatal mortality. Therefore, clinical practices contributing to the higher rates (e.g., 31% US rate) should be carefully analyzed, in an attempt to identify opportunities for reduction, without incurring compromise to mother and/or neonate.

Spong et al. [5] in a joint statement with the National Institute of Child Health and Human Development (NICHD), American College of Ob/Gyn (ACOG), and Society for Maternal Fetal Medicine (SMFM), described several opportunities for reducing the primary C section rate in an attempt to affect favorably, the overall C section rate. One of the most important suggested opportunities included allowing for longer than traditionally estimated times for normal latent and active phases of the first and second stages of labor, thus allowing women to greatly increase their chances of undergoing a successful vaginal delivery.

We published our findings related to instituting a multi-strategy approach towards reducing cesarean section rates at an urban Community Hospital [6]. We initially calculated a target (reduced) cesarean section rate of 29%, which was a 10 point drop from the existing rate of 39%, which we deemed as unacceptably high for our Institution and patient demographics. Four specific interventions were rolled out, and consisted of:

- a. Prior approval by the Chair or Obstetrics Service Chief was required for every scheduled cesarean section.
- b. All patients who had one or two prior cesarean sections were considered as candidates for a trial of labor in order to achieve a vaginal birth after cesarean delivery. Therefore, all patients had to receive information about VBAC either by attending a class taught by qualified midwives or by reading an ACOG approved patient education pamphlet regarding VBACs. This information was recorded into the patient's chart.
- c. All intrapartum cesarean sections required a second opinion. This was obtained by any clinician/colleague who was present on labor and delivery at the time the decision was made. If a difference of opinion occurred, the Director of Maternal Fetal Medicine reviewed the situation and made the ultimate decision.
- d. Individual cesarean section rates of all providers were prominently displayed on labor and delivery. This resulted in healthy competition amongst attendings especially when patient demographics and practice groups were similar.

Over the study period, the overall cesarean section rate decreased to 29%, without any compromise in maternal or neonatal outcomes. An additional finding was that, regardless of the indications for the cesarean sections, the overall rates of the Service attendings had a statistically significant decrease, most likely due to the implementation of Items b and c which allowed for other colleagues to weigh in to the decision-making process and to encourage patients to also participate in their own obstetrical management due to having attended VBAC classes (Table 1).

2.2. Rates of vaginal birth after cesarean section

A large contributor to the overall cesarean section rate is the category of elective repeat cesarean sections, because the overall number of trials of labor after cesarean section is very low. Although, rates of vaginal birth after cesarean have fluctuated markedly over the past two decades, currently, women who attempt a trial of labor after cesarean delivery have a 60–80% success rate. Several factors have contributed to these outcomes. These include Craigin's dictum, "once a cesarean, always a cesarean," [7] the ACOG practice bulletin that allows elective cesarean delivery upon maternal request, and the document that states in order for a patient to attempt a trial of labor, anesthesia and surgical capabilities must be "immediately available,"

	Control group N = 1380	Study group N = 993	p Value
Private attendings	200	170	0.163
Service attendings	150*	79*	0.002*
Dystocia	424 (11.9%)	561 (16.4%)	NS
Non reassuring fetal tracings	225 (6.3%)	247 (7.2%)	NS

*Statistically significant.

Table 1. Cesarean sections: private versus service attendings and indications.

[8, 9] and the medicolegal climate. However, in a push toward increasing the VBAC rates for eligible women, several payers (Government and Private) adjusted the payments for cesarean sections and vaginal deliveries according to patients' eligibility for trials of labor and successful VBAC, hoping to maximize this option for management of a patient's birth [10].

Roberts et al. [11] published the results of a survey of 227 Obstetric Care Hospitals regarding the availability of VBAC services after ACOG's statements regarding the need for having obstetrical emergency services readily available. The average number of deliveries per hospital was 811 per year. Approximately two-third of the hospitals (154 of the 224 responding hospitals) did not change their VBAC policy regardless of any "external" factors, including ACOG statements. However, one-third of the responding hospitals (68/229) had discontinued offering VBACs due to external factors, including the ACOG statements. Thus, the women receiving care in such facilities would be prevented from having this option, and unfortunately, many of these facilities were in remote and underserved areas.

Whenever a patient wishes to attempt a trial of labor, in order to achieve a VBAC, she should be made aware of the risks and complications of this plan. The discussion should include the risk of possible harm to mother and baby (uterine rupture, hemorrhage, injury to adjacent organs, severe fetal hypoxia or death). Additionally, the mother should be informed about the likelihood of success in this clinical setting. We published our findings regarding the effect, if any, of the extent of cervical dilation at cesarean delivery upon the subsequent VBAC rate [12]. Relevant records of the index pregnancy (Group 1) were reviewed for maximum cervical dilation at cesarean delivery and compared to the VBAC success rate of these patients in the subsequent pregnancy (Group 2). Of the 1917 patients, if the indication for a cesarean section in Group 1 was malpresentation, non-reassuring fetal heart rate tracing, and arrest disorder, the overall success rate of a subsequent VBAC was approximately 71%. However, in the subset of patients who had undergone the original cesarean section for arrest of descent (after achieving full dilation), the success rate was statistically significantly lower, being only 13%. Thus, patients who attempt a VBAC should be counseled about their reduced rates of a successful VBAC in situations where the prior cesarean delivery occurred when she was fully dilated.

2.3. Higher order cesarean sections

One of the known consequences of a patient undergoing a cesarean section delivery is the higher than baseline rate that she will undergo a repeat cesarean section, either as a scheduled repeat or after a failed trial of labor. If patients choose to have more than three subsequent cesarean deliveries, there is a greater likelihood of serious morbidity to the mother and baby. Higher order cesarean sections have variously been described as >3 or >4 such procedures. Some investigators have described increased intraoperative and postoperative morbidity in these cases, whereas others have not found any increase in complications [13–16]. The complications included increased rates of hemorrhage, injury to adjacent organs, blood transfusions, longer hospital stays, and peripartum hysterectomies.

We retrospectively reviewed the complication rates of patients undergoing higher order cesarean deliveries at our Institution, in the setting of a unique program wherein a senior Obstetrician is always present 24/7 with the intent to assist with any surgery and/or manage complications [17]. The 826 patients who had undergone a higher order cesarean section

were divided into four groups according to the number of previous cesarean sections. The incidence of intraoperative complications (injury to adjacent organs) and length of hospital stay were not increased in patients undergoing higher order (≥ 3) cesarean sections. In the patients who had ≥ 3 prior cesarean sections, there was a statistically significant increase in total operating time, rate of blood transfusions, and peripartum hysterectomies. There were no differences in neonatal outcomes amongst the four groups (**Table 2**).

We attributed these “improved” outcomes to the presence of a 24/7 senior Obstetrician who was available to assist in prevention and management of complications in these high acuity clinical scenarios.

2.4. Quantification of blood loss and resuscitation in postpartum hemorrhage

Postpartum hemorrhage is one of the leading complications in a cesarean section. Therefore, accurate knowledge of the amount of postpartum blood loss is essential for the appropriate and safe management of these patients. Visual estimations of blood loss (EBL) are known to be incorrect by as much as 50%, with larger volumes of blood loss being underestimated and smaller volumes being overestimated. This inaccuracy in visual determinations of blood loss is known to be independent of the provider’s age and clinical experience. [18].

We quantified blood loss (QBL) after delivery by actual measurements of the total blood lost [19]. During and after each delivery, trained Nursing personnel weighed all the blood soaked materials and blood clots and measured the amounts in the under-buttock drapes. Specially labeled weighing scales depicting pre-calculated dry weights of patient gowns and items such as towels, sheets that are commonly used to soak up blood, were all measured.

Morbidity	Group 1 Sec Rpt. C/S	Group 2 Sec Rpt.C/S Failed TOLAC	Group 3 3rd/4 th Rpt. C/S	Group 4 $\geq 5^{\text{th}}$ Rpt. C/S	p value
Placenta accreta (%)	3.1%	2.9%	3.3%	3.3%	NS
Intra-op adhesions (Significant) (%)	41%	43%	52%	51.6%	NS
Cystotomy (%)	0.7%	0.9%	1.1%	1.1%	NS
Bowel injury (%)	0.1%	0.1%	0.1%	0.1%	NS
Total (Quantitative) blood loss (cc) ≥ 1 u	922 \pm 43	980 \pm 51	1355 \pm 186	1416 \pm 92	<0.05
Blood transfusions ≥ 1 u	10.3%	11.2%	21%	21.6%	<0.05
Total operating time (min.)	121 \pm 18	129 \pm 21	165 \pm 43	173 \pm 26	<0.05
Hysterectomy (peripartum, %)	2.1%	4.1%	3.2%	4.3%	NS

Table 2. Maternal morbidity of patients in the four groups.

This standardized objective method of quantification of the blood loss at delivery revealed a mean value of 300 cc after uncomplicated vaginal delivery and 900 cc after uncomplicated cesarean section. These findings were similar to the estimated blood loss measurements that had been performed prior to instituting this approach and were consistent with findings in the literature (**Figure 2**). Thus, we suggested that the standard definition of partum hemorrhage of >1000 cc blood loss after a cesarean section could reliably be used as a trigger for the occurrence of this serious complication.

A major component of the management of postpartum hemorrhage is aggressive volume repletion. Serum lactate levels are used in the management of trauma patients because they reliably indicate tissue hypoperfusion [20]. However, their predictive role in the management of PPH for appropriateness of volume resuscitation remains to be elucidated.

We reviewed the outcomes of 1314 patients with postpartum hemorrhage in whom the blood loss was ≥ 1500 cc [21]. As an initial step in their management, all patients received a second IV line for increased fluid administration. When this IV line was inserted, blood was initially drawn for a CBC, coagulation profile, and venous lactate level. All results were obtained within 30 min of blood draw. The venous lactate levels were “normal” (≤ 2), more than 93% were hemodynamically stable (no hypotension and no tachycardia) and only 9% required a blood transfusion. When the venous lactate levels were “elevated” (≥ 4), 68% demonstrated hemodynamic instability and 91% received 1 or more units of blood transfusion based on their clinical symptoms or ≥ 10 point drop in hematocrit (**Table 3**). We suggest that venous lactate levels are a reliable indicator of tissue hypo perfusion in obstetrical hemorrhage and should be used as a trigger for blood transfusions when resuscitating these patients regardless of the hemodynamic status or hematocrit levels.

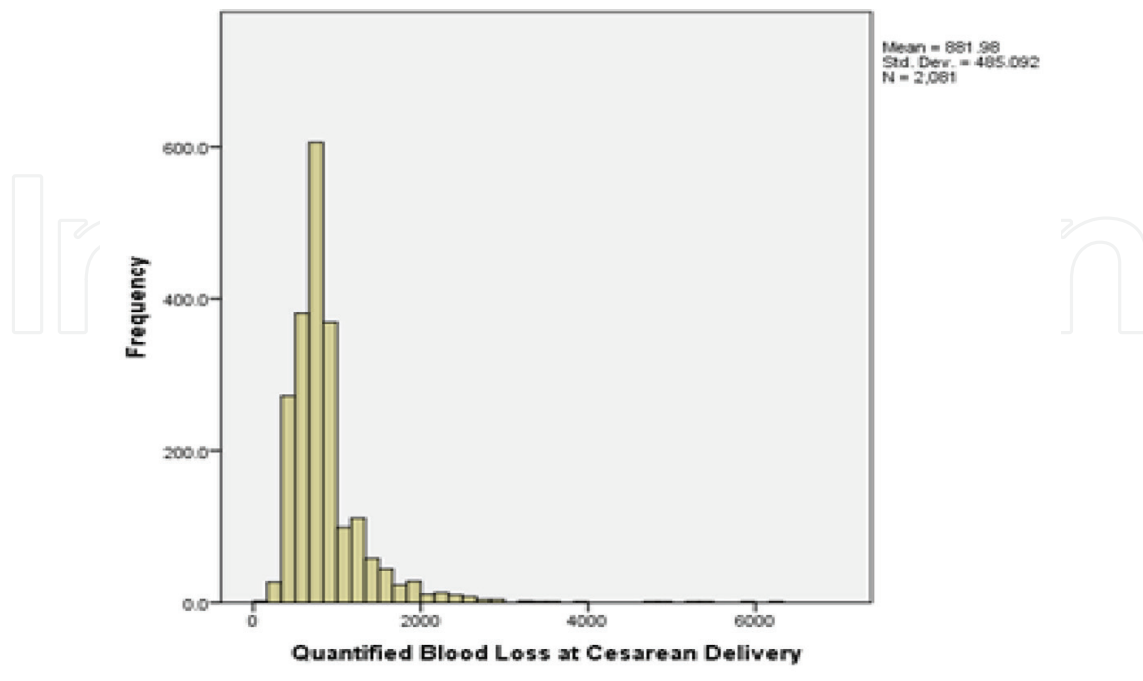


Figure 2. Quantified blood loss at Cesarean delivery.

Lactate levels as predictors for blood transfusions in PPH

Table 3. Correlation b/w Lactate Levels & Outcomes

	Group 1	Group 2	Group 3	P value
Lactate mEq/L	≤ 2 mEq/L	2.1-3.9 mEq/L	≥ 4.0 mEq/L	
N	201	381	306	
BP ≤ 60/40 HR ≥ 120 bpm	66 (33%)	141 (37%)	187 (61%)	<0.05
Hct drop of ≥ 10 points	60 (30%)	99 (26%)	141 (46%)	<0.05
Transfusion ≥ 1 unit PRBC	22 (11%)	57 (15%)	277 (91%)	<0.05



Table 3. Lactate levels as predictors for blood transfusions in PPH.

2.5. Self-perceived stress during pregnancy

Women experience different types of stresses during their lifetimes. Even though pregnancy and the postpartum period are universally considered to be a joyous event, it is paradoxically recognized as a stressful time in a woman's life. Psychological stress is known to have negative effects on maternal mental health, including depression and anxiety [22, 23]. This situation can be exacerbated when a woman is undergoing a cesarean section because of her concerns regarding her own recovery and also regarding the availability of support systems for her. We studied whether socioeconomic status affects a patient's self-perception of her own stress levels during the pregnancy and postpartum period, including in the setting of her undergoing a cesarean section [24]. There were 1006 patients with uncomplicated pregnancies, who were administered a validated questionnaire to assess stress levels at three study points: 1st trimester, 2nd trimester and at the 4–6 week postpartum visit.

The majority of patients self-reported high stress scores during the 1st trimester, likely due to fears and concerns about the pregnancy outcomes. The women reported lowest stress levels during the 2nd trimester, most likely due to their having a sense of wellbeing, especially in the absence of complications. Regardless of socioeconomic status, many women reported high stress levels during the postpartum period, likely due their concerns about their own recovery in addition to addressing the needs of their newborns.

3. Conclusion

Given that cesarean sections are the most common surgical procedures performed in the USA, we suggest that applying the above mentioned evidence-based techniques and criteria, in the management of these operations, will greatly assist in ensuring safe and improved outcomes in these patients.

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