The Relationship between a New Type of Partogram and Rate of Cesarean Section: An Updated Review

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THE PARTOGRAPH

Introduction

Labor complications especially prolonged and obstructed labors are an important cause of mortality, morbidity and long-term disabilities for both mothers and babies, particularly in under-resourced settings [1]. Annually, direct obstetric causes result in 210,000 maternal deaths during pregnancy, childbirth, and the post-partum period [2].

The identification and appropriate management of women at high risk of labor complications (including at the first contact with the health system), careful monitoring throughout labor and childbirth, timely use of effective interventions (e.g. labor augmentation, assisted vaginal delivery and cesarean section) together with appropriate neonatal resuscitation would avert most of the avoidable intrapartum related maternal and perinatal deaths [1].

Partograph or partogram – a Greek word meaning "Labor Curve" is a simple inexpensive graphical record showing progress of labor and salient maternal and fetal conditions during labor [3]. It is a pre-printed single-page – usually in paper version – set of graphs and tables of measurements to be filled out during labor. It provides a standard structure for the most relevant patient data, and its graphs visualize the progression of labor, making prolonged labor more apparent [2]. It detects labor that is not progressing normally, indicates when augmentation of labor is appropriate and recognizes cephalo-pelvic disproportion long before labor becomes "obstructed". It serves as an early warning system and assists in early decision making on transfer, augmentation and termination of labour [4].

The use of partograph to monitor the progress of labour is one of the globally recognized tools for reducing maternal mortality [5]. It has demonstrated a reduction in obstructed labor when used to track patients [2].

History of Partograph

The first obstetrician to describe the progress of labor graphically was Friedman [6], following his study of the cervical dilatation of 100 African primigravidae at term. The women were given frequent rectal examinations and their progress was recorded in centimetres of dilatation per hour, producing a slope resembling a sigmoid curve (‘S’ shaped) (Figure 1). This became known as the cervicograph [7].
In an attempt to utilize midwives efficiently in a hospital and clinic service in Zimbabwe (then Rhodesia), where doctors were in short supply, Philpott, [8] developed a partograph from this original cervicograph. This provided a practical tool for recording all intrapartum details, not just cervical dilatation.

An ‘alert line’ was added following the results of a prospective study of 624 women [9]. The alert line was straight, not curved, and was a modification of the mean rate of cervical dilatation of the slowest 10% of primigravid women who were in the active phase of labor. This line represented a progress rate of 1 cm per hour. Should a woman’s cervical dilatation progress more slowly, it would cross this alert line and arrangements were made to transfer her from a peripheral unit to a central unit where prolonged labor could be managed [7].

The next stage of partograph development was the introduction of an 'action line', four hours to the right of the alert line [10]. This line was developed to identify primary inefficient uterine activity to prompt appropriate management. Correction of primary inefficient uterine activity would usually be with an intervention such as amniotomy or oxytocin infusion or both [7].

In 1987, WHO launched the safe motherhood initiative [11], since then WHO has published three different types of partographs. The first of these partograms also known as composite partograph includes latent phase of 8 h and an active phase starting at 3-cm cervical dilatation. It has an alert line with a slope at 1 cm/h and the action line 4 h to the right and parallel to alert line. It also provides space for recording descent of fetal head, maternal condition, fetal condition and medicines administered (Figure 2) [12].
Components of Partograph

At the top part of the partograph, there is an identification part where the name of the parturient, her gravid and para status, the hospital registration number, the date and time of admission of the laboring woman and time of rupture of membranes are to be recorded [3]. The main components of the graph are:

Record of progress of labor is monitored by cervical dilatation, descent of head and uterine contractions.

Fetal condition is monitored by fetal heart rate, color of amniotic fluid and molding of the fetal skull.

Maternal condition is assessed by pulse, BP, temperature, urine output and urine for protein and acetone.

A separate space is given to enter drugs, IV fluids and oxytocin [12].

Progress of Labor

Cervical Dilatation:

The central feature of the partogram is a graph where cervical dilatation is plotted. Along the left side, there are squares from 0 to 10, each representing 1-cm dilatation. Along the bottom of graph are numbers 0–24 each presenting 1 h.

The first stage of labor is divided into latent and active phase. The latent phase is from 0 to 3 cm, and it lasts up to 8 h. The active phase is from 3 to 10 cm (full cervical dilatation). The dilatation of cervix is plotted with “x.”
When a woman is admitted in the active phase, the cervical dilatation is plotted on the alert line. If progress of labor is satisfactory, the plotting of cervical dilatation will remain on the left of alert line (Figure 3).

When woman is admitted in the latent phase, dilatation between 0 and 3 cm should be plotted in latent phase. But when woman goes into active phase, the recording must be transferred to the alert line as shown by the broken line (Figure 4).

**Descent of Fetal Head**

Descent of the head should always be assessed by abdominal examination before doing a vaginal examination as the large caput may give a false judgment about the station. The level of the fetal head by abdominal palpitation is expressed in terms of fifths above the brims.

On the left side of the graph is the word descent with numbers from 5 to 0. Descent is plotted with “O” on cervicograph (Figure 5). [12]
Figure (5): Plotting descent of the head \cite{12}.

**Uterine Contractions**

Below the cervical dilatation, there is a space for recording uterine contractions per 10 min and

- **Dots**
  - Contractions Less than 20 seconds

- **Diagonal lines**
  - Contractions lasting between 20-40 seconds

- **Solid Shading**
  - Contractions more than 40 seconds

The scale is numbered from 1 to 5. Each square represents one contraction. So if two contractions are felt in 10 min, two squares are shaded. Duration of contraction is indicated by the following symbols:

Figure (6): Duration of contraction on partograph \cite{12}.

**The Fetal Condition**

**Fetal Heart Rate**

Immediately below the patient’s identification details, there is fetal heart rate record. The scale for fetal heart rate ranges from 100 to 180 beats/min.

**Liquor**

Below the fetal heart rate, there are two rows, and the first is for liquor. Once the membranes rupture, the color of amniotic fluid is noted

- If the membranes are intact, write ‘I’.
- If the liquor is clear, write ‘C’.
- If the liquor is meconium-stained, write ‘M’.
- If the liquor is absent, write ‘A’
**Maternal Condition**

All the recordings for the maternal condition are entered at the foot of the partograph below the recording of uterine contraction. Maternal vital signs such as temperature, pulse, BP, urine output and urine for protein and acetone are monitored.

**Importance of Alert And Action Lines:**

In normal labor during the active phase, plotting of cervical dilatation will remain on the left of or on the alert line. If it moves to the right of the alert line, labor may be prolonged. In this situation, transfer the patient if facility for emergency intervention is not available. Transfer allows adequate time for assessment or intervention till she reaches the action line. Action line is 4 h to the right of alert line. Assess the cause of slow progress and take necessary action. Action should be taken in a place where facility for dealing with obstetric emergencies is available [12].

**Paperless Partograph**

Even after the WHO simplified the partograph, it is rarely used. The main reasons being it may be too time-consuming for overburdened doctors and may be too complicated for the birth attendants present in rural settings. Therefore, there is an urgent need to make the partograph more user-friendly [12].

**Dr. A.K Debdas** from India has proposed a new low-skill method called paperless partogram to adapt to local needs [13]. It is a simple, low-skill method for predicting the expected time of delivery (ETD), hence preventing prolonged labor. In this, the care provider records two timings, ALERT ETD (estimated time of delivery) and an ACTION ETD [3].

The ALERT calculation uses the principal that cervix dilates 1 cm/h when woman is in active phase. So, the birth attendant simply adds 6 h to the time at which a woman becomes 4 cm dilated. This way ALERT ETD is calculated. To calculate ACTION ETD, 4 h is added to ALERT ETD. Both the timings are written on patient’s indoor paper. The ACTION ETD is circled in red. At the time of ALERT ETD, if the patient has not delivered and the current setup lacks the operative facility, then the arrangement for transportation should be made. At the time of ACTION ETD, the woman is at risk of prolonged labor. So, an immediate action must be taken to deliver her promptly [12].

This strategy is cheap and easy to use. It takes only few seconds for calculation, requires only basic addition and has the potential for preventing prolonged labor.

**ePartograph (electronic partograph)**

Factors contributing to suboptimal partograph use include lack of availability of partographs and labor management guidelines, insufficient knowledge, training or supportive supervision of SBAs related to partograph use, negative perceptions of the partograph and its value, and insufficient institutional commitment to partograph use [1].

To address documented challenges, Johns Hopkins Program for International Education in Gynecology and Obstetrics (Jhpiego) and the Johns Hopkins Center for Bioengineering Innovation and Design (JHU- CBID) have developed the ePartograph, a handheld device and software platform based on the current partograph recommended by the World Health Organization [14], with particular attention to improving ease and efficiency of real-time documentation, increasing visibility of labor management data to nurses and supervisors to inform decision-making, and providing visual and auditory cues for timely and appropriate clinical decision-making during labor.

The ePartogram was developed from 2010 to 2015 by a team of engineers, public health experts, experienced clinicians, and software developers with iterative end-user feedback, in collaboration with systems development partner D-Tree International. These stakeholders were
consulted throughout the development process to inform the product specifications and design [15].

However, because not every “clinical rule” for ePartogram use is printed in WHO documentation, WHO guidance was augmented with Jhpiego clinical expertise. Jhpiego doctors, nurses, and midwives were consulted in developing priority clinical rules that would address the leading intrapartum complications; these rules were externally validated by practicing clinicians from low-resource settings. The resulting ePartogram application includes auditory reminders that prompt skilled birth attendants to take measurements, such as obtaining fetal heart rate every 30 min, and visual alerts to flag measurements indicating the need for follow-up, for example, if the dilation measurement crosses the alert or action line [15].

**CESAREAN SECTION**

**Definition**

Cesarean delivery is defined as the delivery of a fetus through surgical incisions made through the abdominal wall (laparotomy) and the uterine wall (hysterotomy) [16].

Cesarean deliveries were initially performed to resolve maternal or fetal complications not amenable to vaginal delivery, either for mechanical limitations or to temporize delivery for maternal or fetal benefit [17].

**Essential Update: ACOG/SMFM Guidelines Released For Prevention of Primary Cesarean Delivery**

The American College of Obstetricians and Gynecologists (ACOG) and the Society for Maternal-Fetal Medicine (SMFM) have released joint guidelines for the safe prevention of primary cesarean delivery. These include the following [18]:

- Prolonged latent-phase labor should be permitted.
- The start of active-phase labor can be defined as cervical dilation of 6 cm, rather than 4 cm
  - **a)** In the active phase, more time should be permitted for labor to progress
  - **b)** Multiparous women should be allowed to push for 2 or more hours and primiparous women for 3 or more hours.
  - **c)** Techniques to aid vaginal delivery, such as the use of forceps, should be employed [17].
  - **d)** Access to nonmedical interventions during labor, such as continuous support during labor and delivery, should be increased.
  - **e)** External cephalic version should be performed for breech presentation
  - **f)** Women with twin gestations should, if the first twin is in cephalic presentation, be permitted a trial of labor [19].

**Indications**

Currently, cesarean deliveries are performed for a variety of fetal and maternal indications. The indications have expanded to consider the patient’s wishes and preferences. The indications for cesarean delivery include [20]:

**Maternal Indications**

- **a)** Repeat cesarean delivery
- **b)** Obstructive lesions in the lower genital tract, including leiomyomas of the lower uterine segment that interfere with engagement of the fetal head.
c) Pelvic abnormalities that preclude engagement or interfere with descent of the fetal presentation in labor

**Fetal Indications**

1) Situations in which neonatal morbidity and mortality could be decreased by the prevention of trauma
2) Malpresentations (e.g., preterm breech presentations, non-frank breech term fetuses)
3) Certain congenital malformations or skeletal disorders

**Indications For Cesarean Delivery That Benefit The Mother And The Fetus:**

1. Abnormal placentation (e.g., placenta previa, placenta accreta)
2. Abnormal labor due to cephalopelvic disproportion [20]

**Contraindications**

There are few contraindications to performing a cesarean delivery. In some circumstances, a cesarean delivery should be avoided, such as [21]: If the fetus has a known karyotypic abnormality (trisomy 13 or 18) or known congenital anomaly that may lead to death.

**Cesarean Delivery on Maternal Request**

Controversy exists regarding elective cesarean delivery on maternal request “CDMR” [22]. The 2013 American College of Obstetricians and Gynecologists (ACOG) Committee on Obstetric Practice [23] and 2006 National Institutes of Health (NIH) consensus committee determined that the evidence supporting this concept was not conclusive and that more research is needed [24].

Both committees provided the following recommendations regarding CDMR [23,24]:

- d) Unless there are maternal or fetal indications for cesarean delivery, vaginal delivery should be recommended.
- e) CDMR should not be performed before 39 weeks’ gestation without verifying fetal lung maturity.
- f) CDMR is not recommended for women who want more children (increased risk for placenta previa/accreta and gravid hysterectomy).
- g) The inavailability of effective analgesia should not be a determinant for CDMR.

**Preoperative Management**

The followings are included in preoperative management [25]:

- a) Fasting time of at least 2 hours from clear liquids, 6 hours from a light meal, and 8 hours from a regular meal
- b) Placement of an intravenous (IV) line.
- c) Infusion of IV fluids (e.g., lactated Ringer solution or saline with 5% dextrose).
- d) Placement of a Foley catheter (to drain the bladder and to monitor urine output)
- e) Placement of an external fetal monitor and monitors for the patient’s blood pressure, pulse, and oxygen saturation.
- f) Preoperative antibiotic prophylaxis (decreases risk of endometritis after elective cesarean delivery by 76%, regardless of the type of cesarean delivery [emergent or elective]).
- g) Evaluation by the surgeon and the anesthesiologist.
Preoperative Monitoring:
Monitors are placed to allow the patient’s blood pressure, pulse, and oxygen saturation to be monitored before administration of anesthesia [26].

Before surgery, a Foley catheter is placed so that the bladder can be drained during the procedure and urine output can be monitored to help evaluate fluid status. After regional anesthesia, patients are unable to void spontaneously for as long as 24 hours [27].

Single-dose antibiotic therapy is recommended for its effectiveness, lower cost, decreased potential toxicity, and decreased development of resistance. Prolonged surgery, excessive blood loss, and maternal obesity may require repeat or higher dosing [23].

Laboratory Testing:
The following laboratory studies may be obtained prior to cesarean delivery [28]:

a) Complete blood count.
b) Blood type and screen, cross-match.
c) Screening tests for human immunodeficiency virus, hepatitis B, syphilis.
d) Coagulation studies (e.g., prothrombin and activated partial thromboplastin times, fibrinogen level).

Imaging Studies:
In labor and delivery, document fetal position and estimated fetal weight. Although ultrasonography is commonly used to estimate fetal weight, a prospective study reported the sensitivity of clinical and ultrasonographic prediction of macrosomia, respectively, as 68% and 58% [29].

Technique
The technique for cesarean delivery includes the following [30]:

a) Laparotomy via midline infraumbilical, vertical, or transverse (e.g., Pfannenstiel, Joel Cohen) incision.
b) Hysterotomy via a transverse (Monroe-Kerr) or vertical (e.g., Kronig, DeLee) incision
c) Fetal delivery
d) Uterine repair
e) Closure

As with any procedure, take care to avoid injury to adjacent organs. Potential complications include bladder or bowel injury. If a cystotomy or bowel injury is suspected, it should be evaluated thoroughly after the baby is delivered and hemostasis of the uterus is achieved [31].

The anesthesiologist monitors the patient’s vital signs and tracks fluid intake and urine output. The average blood loss associated with a cesarean delivery is approximately 1000 ml. If a significant blood loss is encountered or anticipated, assess the hemoglobin level and cross-match blood [32].

Most of the physiologic changes occurring during a cesarean delivery are secondary to the physiologic adaptations to pregnancy. The method of anesthesia used to perform the procedure also influences the physiologic adaptations that the mother undergoes during the procedure [33].
Uterine Closure

If the uterine incision is hemostatic, the uterine fundus is replaced into the abdominal cavity (unless a concurrent tubal ligation is to be performed). The incision is re-inspected for hemostasis, and the bladder flap is also inspected. The paracolic gutters are visualized, and any blood clots are removed with laparotomy sponges [34].

Many physicians prefer to not close the peritoneum because these surfaces reapproximate within 24-48 hours and can heal without scar formation. Furthermore, the rectus muscles do not need to be reapproximated [35].

The subfascial and muscle tissue is inspected for bleeding, and, if hemostatic, the fascia is closed by a running nonlocking stitch, and synthetic braided or monofilament sutures are preferred over chromic sutures [36].

The subcutaneous tissue should be inspected for hemostasis and can be irrigated according to physician preference. The subcutaneous tissue usually does not have to be reapproximated if not greater than 2 cm.

The skin edges can be closed either with a subcuticular stitches or with staples (removed 3 or 4 days postoperatively) [37].

Postoperative Management

a) Routine postoperative assessment
b) Monitoring of vital signs, urine output, and amount of vaginal bleeding
c) Palpation of the fundus
d) IV fluids; advance to oral diet as appropriate
e) IV or intramuscular (IM) analgesia if patient did not receive a long-acting analgesic or had general anesthesia
f) Ambulation on postoperative day 1; advance as tolerated
g) If patient plans to breastfeed, initiate within a few hours after delivery.
h) Discharge on postoperative day 3 or 4, if no complications
i) Discuss contraception as well as refraining from intercourse for 4-6 weeks postpartum.

Complications

a) Approximately 2-fold increase in maternal mortality and morbidity with cesarean delivery relative to a vaginal delivery [38].
b) Infection (e.g. postpartum endomyometritis, fascial dehiscence, wound, urinary tract).
c) Thromboembolic disease (e.g., deep venous thrombosis).
d) Anesthetic complications
e) Surgical injury (e.g., uterine lacerations; bladder, bowel, ureteral injuries)
f) Uterine atony.
g) Delayed return of bowel function [39].

Compared with a vaginal delivery, maternal mortality and especially morbidity is increased with cesarean delivery to approximately twice the rate after a vaginal delivery [38]. The overall maternal mortality rate is 6-22 deaths per 100,000 live births, with approximately one third to one half of maternal deaths after cesarean delivery being directly attributable to the operative procedure itself [39].
**Intraoperative Complications**

Uterine lacerations, especially of the lower uterine segment, are more common with a transverse uterine incision but they are easily repaired. Take care to identify the uterine vessels when repairing lateral extensions, and think about the ureters when repairing inferior extensions. If the laceration extends into the broad ligament, strongly consider opening the broad ligament medial to the ovaries and identifying the course of the ureters [40].

Bladder injury is an infrequent complication; it is more common with transverse abdominal incisions and in repeat cesarean deliveries. Bladder injury has been reported to occur in more than 10% of uterine ruptures and in approximately 4% of cesarean hysterectomies [41].

Injury to the ureter occurs in up to 0.1% of all cesarean deliveries and up to 0.5% of cesarean hysterectomies. It is most likely to occur in the repair of extensive lacerations of the uterus. Ureteral injury, most commonly occlusion or transection, is usually not recognized during the time of the operation [42].

Bowel injuries occur in less than 0.1% of all cesarean deliveries. The most common risk factor for bowel injury at the time of cesarean delivery is adhesions from prior cesarean deliveries or prior bowel surgery [43].

If the bowel is adherent to the lower portion of the uterus, dissect it sharply. Injuries to the serosa can be repaired with interrupted silk sutures. If the injury is into the lumen, perform a 2-layer closure [44].

Uterine atony is another intraoperative complication that can be encountered in a patient with a multiple gestation, polyhydramnios, or a failed attempt at a vaginal delivery in which the patient was on oxytocin augmentation for a prolonged period. When the uterus is closed, attention must be paid to its overall tone [17].

**Postoperative complications**

Postpartum endomyometritis is increased significantly in patients who have had a cesarean delivery. The rate of endomyometritis is up to 20-fold higher than with a vaginal delivery. The postcesarean rate of endomyometritis can be decreased to approximately 5% with the use prophylactic antibiotics [25].

After a cesarean delivery, the risk of a wound infection ranges from 2.5% to higher than 15%. If chorioamnionitis is present at the time of the procedure, the risk for a wound infection can be as high as 20% [45].

If a wound infection is suspected, open, irrigate, and débride the incision. Then, the open wound can be packed and cleaned several times a day. The wound can be allowed to heal by secondary intention, or, when it has begun to granulate, it can be closed [46].

The second most common etiology for postcesarean febrile morbidity is urinary tract infection (UTI). The incidence ranges from 2-16% and the process of placing an indwelling catheter for the surgery is a risk factor in itself. The incidence of UTIs is increased in patients with diabetes, those who have other comorbidities, and those who have a longer duration of use of the indwelling catheter [47].

Postoperatively, some patients may experience a slow return of bowel function. Postoperative narcotics may delay return of normal bowel function in a few patients. Most respond to conservative therapy, but a small portion may require decompression. In those with a slow return of bowel function, assessment of fluid and electrolyte status must be a priority [46].

Thromboembolic complications are also increased in patients who have undergone a cesarean delivery. Approximately 0.5-1 in 500 pregnant women experience deep venous thrombosis.
The risk for developing a thrombus is increased 3- to 5-fold with a cesarean delivery and in the postpartum period [48].

Another infection-related complication of a cesarean delivery is septic pelvic thrombophlebitis. As many as 2% of patients with an endomyometritis or wound infection can develop this complication, and it is largely a diagnosis of exclusion [49].

References:

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