

The Partograph in Childbirth: An Absolute Essentiality or a Mere Exercise?

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Abstract WHO has recommended use of the partograph, a low-tech paper form that has been hailed as an effective tool for the early detection of maternal and fetal complications during childbirth. Yet despite decades of training and investment, implementation rates and capacity to correctly use the partograph remain low in resource-limited settings. Nevertheless, competent use of the partograph,

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especially using newer technologies, can save maternal and fetal lives by ensuring that labor is closely monitored and that life-threatening complications such as obstructed labor are identified and treated. To address the challenges for using partograph among health workers, health-care systems must establish an environment that supports its correct use. Health-care staff should be updated by providing training and asking them about the difficulties faced at their health center. Then only the real potential of this wonderful tool will be maximally utilized.

Keywords Partograph · Partogram · Labor monitoring · Normal labor · Abnormal labor

Introduction

The partograph or partogram has been established as the “gold standard” labor monitoring tool universally. It has recommended by the World Health Organization (WHO) for use in active labor [1]. The function of the partograph is to monitor the progress of labor and identify and intervene in cases of abnormal labor.

Even though the partograph has been utilized for over four decades in obstetric practice, reports of obstructed labor and its serious maternal and fetal sequelae have questioned the efficacy of the partograph at times. Moreover, evidence of efficacy of partograph is equivocal as suggested by a Cochrane review [2]. However, some of the trials studied in this Cochrane review have limitations with respect to the settings, population studied and conduct of labor. The partograph is an “easy-to-use” tool, but if not used correctly it will affect the final outcome.

In this context, we aim to decipher the efficacy and the utility of the partograph in the contemporary conduct of childbirth across all resource settings and health-care personnel and to suggest solutions to further enhance its efficacy in the optimizing labor outcomes.

Evolution of the Partograph

The development of partograph provided health workers a pictorial overview of labor which can identify pathological labor to allow early intervention.

Most guidelines for normal human labor progress are derived from Friedman’s clinical observations of women in labor. In 1954, he introduced the concept of partogram by graphically plotting cervical dilatation against time. The curve obtained was a sigmoid curve. He divided the first stage of labor into latent phase and active phase. Active phase was further divided into acceleration, maximum

slope and deceleration. From his observations, he obtained the following values [3].

Progress of spontaneous labor at term

Parameter	Median	5th percentile
<i>Nullipara</i>		
Total duration	10.1 h	25.8 h
First stage	9.7 h	24.7 h
Second stage	33 min	117.5 min
Third stage	5 min	30 min
Latent phase	6.4 h	20.6 h
Maximum dilatation rate	3 cm/h	1.2 cm/h
Descent rate	3.3 cm/h	1 cm/h
<i>Multipara</i>		
Total duration	6.2 h	19.5 h
First stage	8 h	18.8 h
Second stage	8.5 min	46.5 min
Third stage	5 min	30 min
Latent phase	4.8 h	13.6 h
Maximum dilatation rate	5.7 cm/h	1.5 cm/h
Descent rate	6.6 cm/h	2.1 cm/h

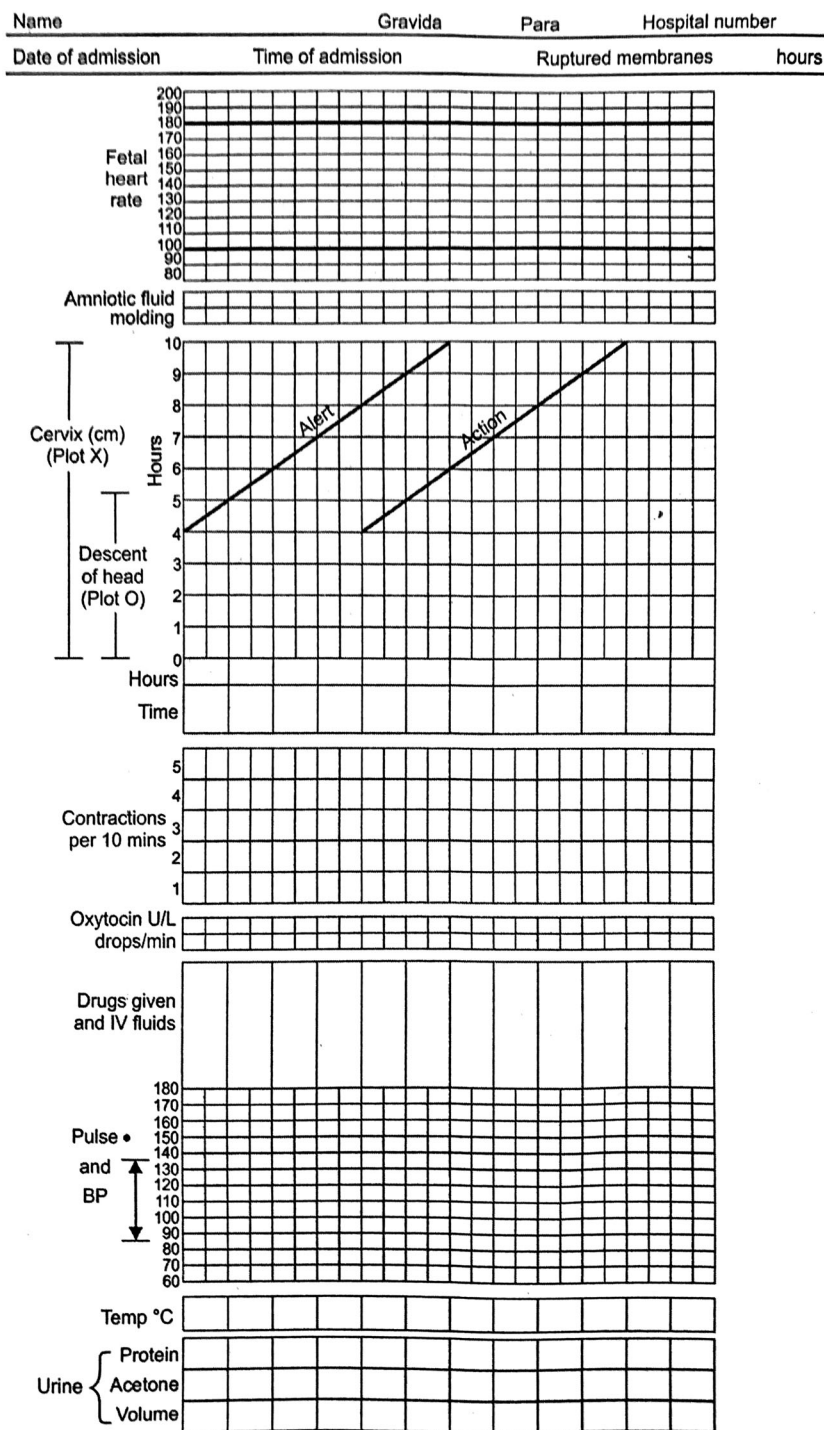
Philpott’s partograph is an improved version of the labor curve. He introduced the alert line and action line. In 1987, WHO launched the safe motherhood initiative, since then WHO has published three different types of partographs. The first of these partograms also known as composite partograph includes 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 (Fig. 1).

WHO modified the partograph in 2000, the latent phase was excluded, and the active phase commenced at 4-cm cervical dilatation [4]. The other features remained the same. The reason for excluding the latent phase was more likelihood of interventions due to prolonged latent phase which was overdiagnosed. There was also difficulty reported in transferring the dilatation from latent phase to active phase (Fig. 2).

WHO further modified the partograph for the third time. This simplified partograph is color-coded. The area to the left of the alert line is colored *green* representing the normal progress. The area to the right of action line is colored *red* indicating dangerously slow progress. The area between the alert and action line is colored *amber* indicating the need for greater vigilance [5] In the trial conducted at Vellore, simplified partogram was rated more user-friendly over composite partogram (Fig. 3).

The graph section of composite partograph [6]:

Fig. 2 WHO modified partograph 2000



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 (Fig. 4).

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 (Fig. 5).

Descent of Fetal Head

Descent of the head should always be assessed by abdominal examination before doing a vaginal examination

Fig. 3 WHO simplified partograph

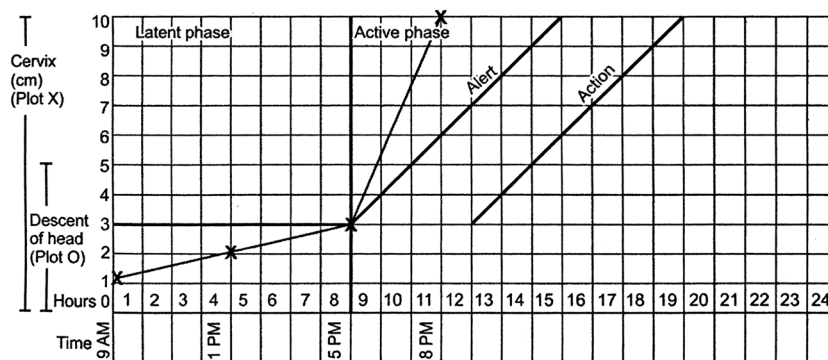
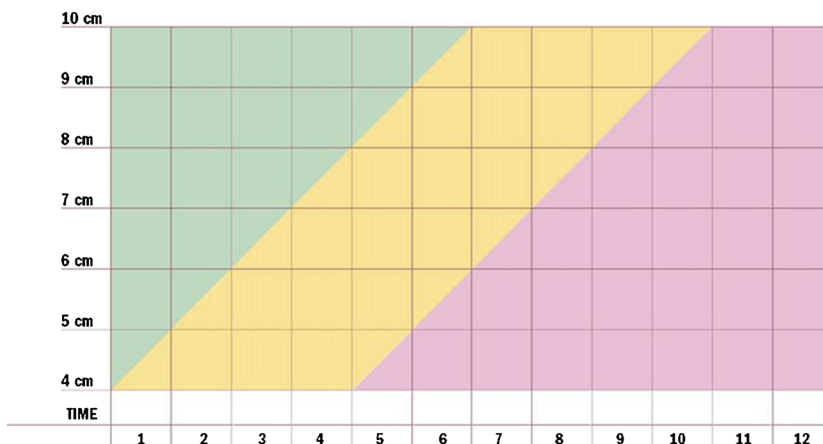


Fig. 4 Normal progress of labor

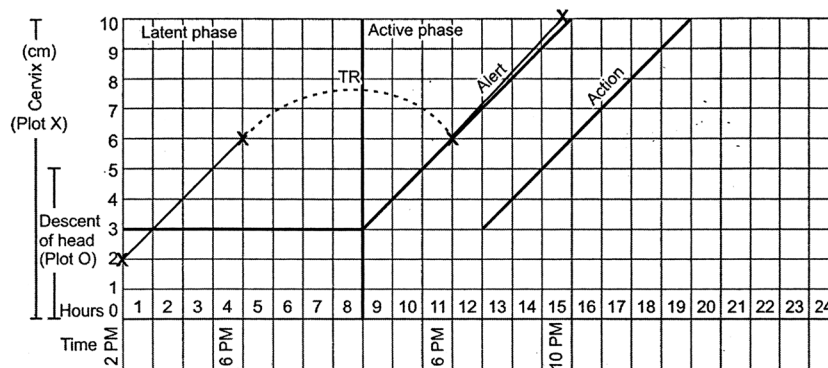


Fig. 5 Transferring dilatation onto the alert line in the active phase of labor

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 (Fig. 6).

Uterine Contractions

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

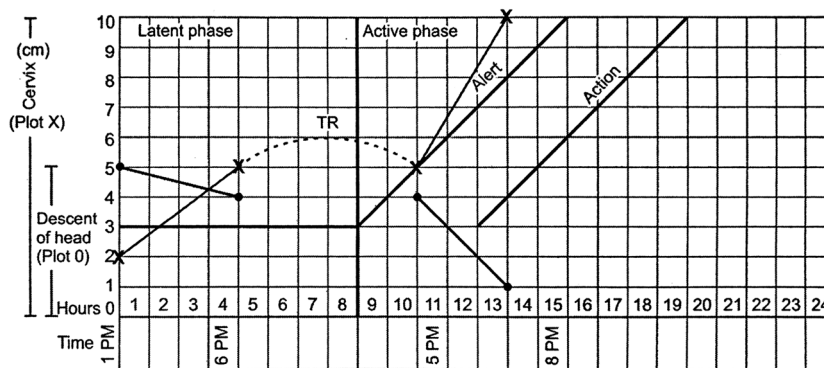





Fig. 6 Plotting descent of the head

Duration of contraction is indicated by the following symbols:

- Dots  Contractions Less than 20 seconds
- Diagonal lines  Contractions lasting between 20-40 seconds
- Solid Shading  Contractions more than 40 seconds

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

1. If the membranes are intact, write ‘I’
2. If the liquor is clear, write ‘C’
3. If the liquor is meconium-stained, write ‘M’
4. If the liquor is absent, write ‘A’

Molding

The row below the liquor is assigned for molding. Increasing molding with high head in pelvis is an ominous sign. It is recorded as follows.

- 0 Bones are separated, and the sutures can be felt easily.
- + Bones are just touching each other
- ++ Bones are overlapping

+++ Bones are overlapping severely

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.

Use of Partogram in Different Resource Settings

The partogram has been heralded as one of the most important advances in modern obstetric care. WHO advocates its use as a necessary tool in the management of labor and recommends its universal use during labor. In under-resourced settings, prolonged labor and delay in decision-making are important causes of adverse obstetric outcomes. Owing to resource constraints in such settings, it is usually not possible to monitor each woman continuously throughout the duration of labor. In such settings, the partogram serves a simple and inexpensive tool to monitor labor in a cost-effective way. However, some health-care practitioners, especially in high-income countries, have

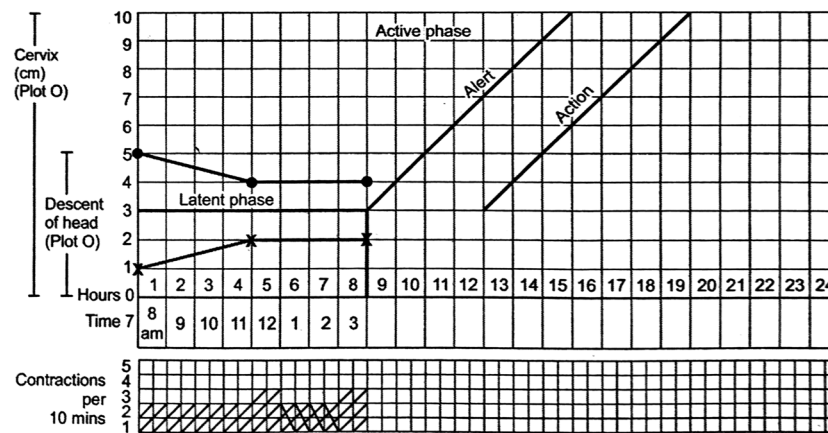


Fig. 7 Prolonged latent phase

questioned its effectiveness. For example, Walraven has suggested that use of the partogram can be an unnecessary interference in clinical work. The present Cochrane review suggests use of a partogram as part of routine care is not associated with improvements in the rates of cesarean section, instrumental vaginal delivery or Apgar scores [2]. Partogram use may have some utility in low-resource settings. Additional evidence is needed to definitively determine the efficacy of partogram use.

Abnormal Labor Patterns

Abnormal labor includes the following patterns.

1. Prolonged latent phase
2. Protraction disorders
3. Arrest disorders
4. Precipitate labor

Prolonged Latent Phase The average duration of latent phase is 6.4 h in primiparas and 4.8 h in multiparas. An abnormally long latent phase is defined as 20 h in nulliparous and 14 h in multiparous patients. The treatment includes therapeutic rest, oxytocin, amniotomy and cervical ripening (Fig. 7).

Protraction Disorders Protracted disorders refer to a series of events including protracted active phase dilatation and protracted descent. Cervical dilatation rate of <1.2 cm/h for primiparas and <1.5 cm/h for multiparas is considered as protracted. Descent <1 cm/h in primiparas and <2 cm/h in multiparas is protracted descent.

Arrest Disorders They include secondary arrest of dilatation that means no progress of cervical dilatation for more than 2 h and arrest of descent that is fetal head does not descend for more than 1 h. If there is no descent in second stage, it is labeled as failure of descent (Figs. 8, 9).

Precipitate Labor Labor which is completed within 3 h is called precipitate labor.

Efficacy of the Partograph

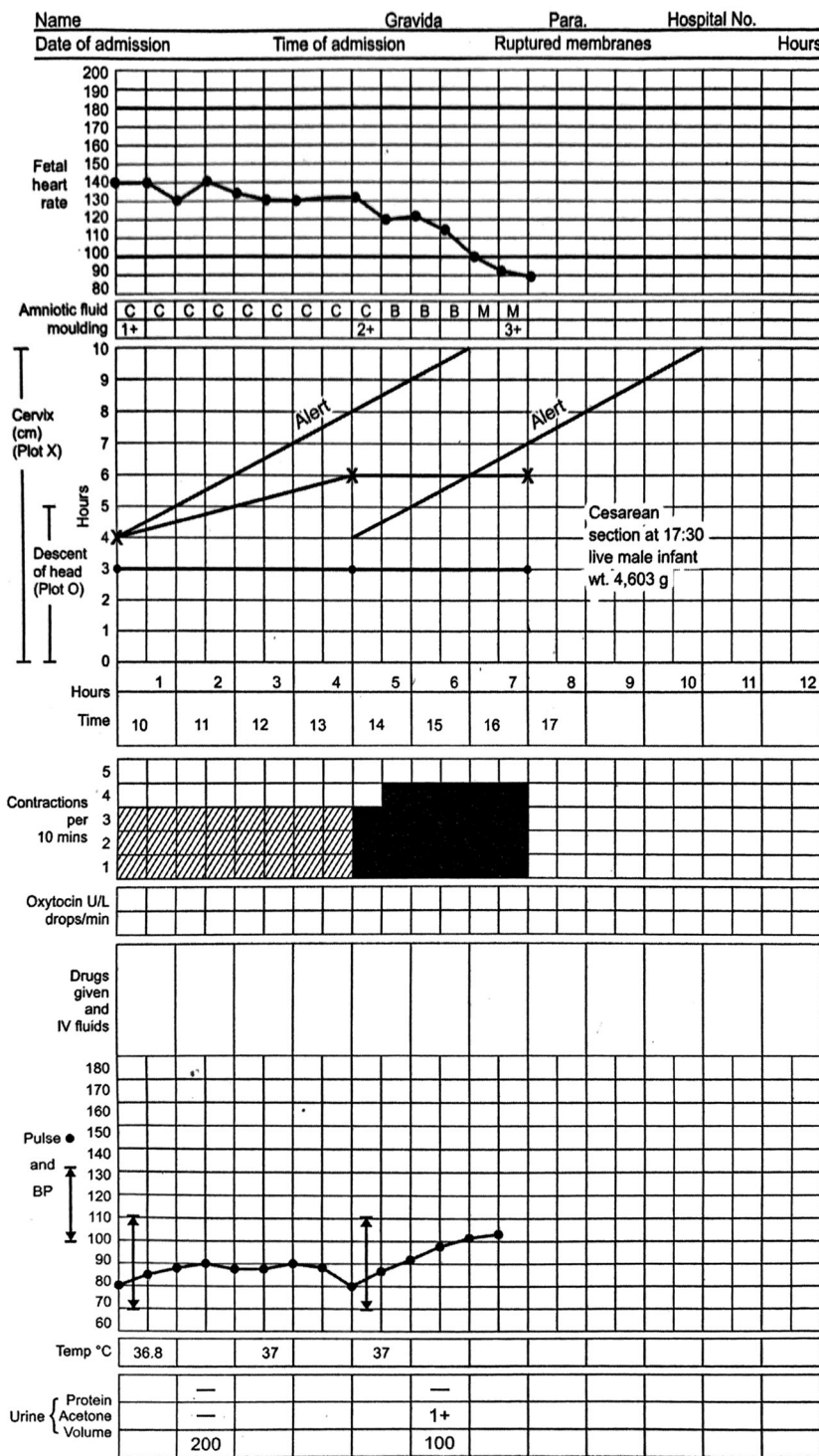
As stated earlier, the Cochrane review of the partograph seems to conclude that evidence reveals that partograph use in labors affects the improvement in clinical outcomes partially. Contrary to this, other studies conclude that partograph use results in shorter labors and better maternal and fetal outcomes [7].

Health-care providers in labor wards experienced the modified partograph to be much more user-friendly [8], as compared to the composite partograph in which they found the latent phase difficult to complete. The modified partograph was found to significantly improve various intra-partum outcomes like a reduced cesarean section rate, augmentation of labor and admissions to neonatal unit as compared to the composite partograph in especially low-resource settings [8].

Overall completion of the partograph to the expected standards is poor which affects its use in clinical practice. Analysis of completed partographs shows that the cervical dilatation and fetal heart rate are usually duly filled as compared to maternal well-being findings [9]. Obviously, this is due to fact that some sections are easier to complete due to equipment availability or better understanding of the partograph, rather than the tool itself [10]. Some obstetricians view the partograph as difficult or time-consuming to complete [9], and evidence shows that other cadres of staff can complete the partograph effectively [11].

There is no doubt as envisioned by its founders, and partograph still works as a trigger for referral and transfer [12] and hence fulfills its primary objectives. Unfortunately, evidence related to augmentation of labor

Fig. 8 Arrest of dilatation



based on partograph findings is limited and on many an occasion there is failure to act on an evident finding shown on a partograph. One reality is that the utility of the partograph as a document of communication tool during the “handover of care” is minimal [8] and transfers to tertiary units are sent without the partograph;

hence, vital information about progress of labor thus far is not known [13].

Evidence is conflicting about the utility of the partograph in general, although studies in low-resource settings suggest that it may have positive impact [14]. Obviously, no detrimental effect of partograph use to

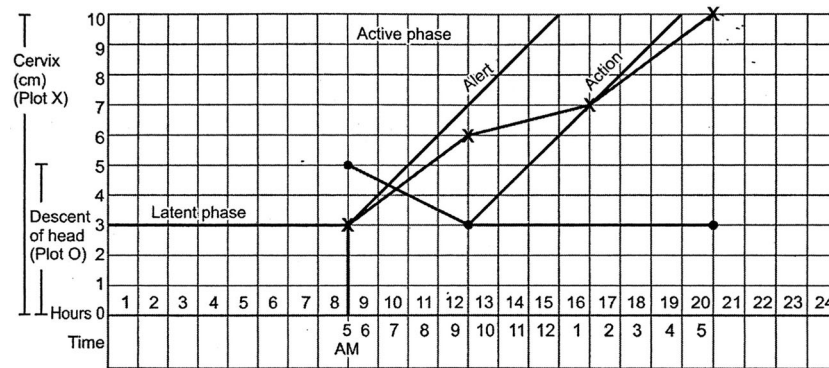


Fig. 9 Arrest of descent

outcome is known [2]. In some studies, use of partograph has resulted in fewer vaginal examinations, reduced length of labor and referral reflected as betterment in quality of care during labor and delivery [15].

Generally, midwives and doctors have expressed positive attitudes toward the use of the partograph [16]. However, it is not always that positive attitudes translate into the actual partograph use in practice, which may be due factors like availability, time, workload and hospital policy [17].

An extremely vital view we wish to put forth is that health workers can take individual responsibility for labor management by using the partograph [18]. This will surely lead to better communication and working, enabling appropriate and timely decision-making and resulting in improved outcomes. Training and supervision of partograph use will enable both wider and standardized use [19]. Hence, partograph use should be an essential part of any obstetric residency or midwife training program.

Although there is no evidence of the cost-effectiveness of the partograph in the literature, we believe that the partograph is a cost-effective tool in any resource setting due to the minimal costs being involved.

Even though the partograph is globally accepted, the prevalence of its use in reality is variable across the world. The reasons for this variation are multiple like lack of or limited availability, busy obstetric units with less staff and finally absence of a uniform policy or guideline for its mandatory implementation [20]. The partograph is mostly used in urban tertiary public health-care facilities by professionally qualified and trained staff as these setups have both adequate human resource and funding. More importantly, these centers have a protocol mandating its use in all labors [21]. Ongoing supervision and support will improve partograph usage [12]. Additionally, regular audits will enhance greater usage and accuracy in labor monitoring [22].

Partograph in Labor: Challenges and Solutions

The greatest challenge in partograph use is to enhance its effective implantation in the management of all labors universally. Unfortunately, the partograph is still not considered as mandatory or central in routine care of all laboring women [23]. This may be because of lack of commitment and inconsistent acceptability for the usage of the partograph in labor rooms. At present though a majority of health-care workers do possess positive attitudes toward the partograph, a few challenges need to be tackled to ensure a favorable environment. These challenges are support by the health system, availability of resources, competence in use and monitoring and evaluation of the partograph in practice.

Positive validation, facility level guidance, evaluation and audit of partographs from experienced seniors and supervisors will enhance the value of the partograph in clinical practice. Adequate availability of resources, (i.e., the partograph and accessory equipment) will result in completion, which is essential to ensure consistent use, but sadly this is still lacking. Individualized training improves knowledge about the partograph [24], but the use of multidisciplinary training strategies results in understanding of roles and promotes coordinated team work [25]. Hands-on training methods improve patient outcomes [26, 27]. All staff members providing care for women in labor should be trained and regularly updated in partograph use. Training should consist of completion and decision-making, like when to start the partograph, when to take action and appropriate referral. A limitation with the partograph use in current practice is the failure to evaluate the tool at facility level in terms of outcomes. This is paramount in evaluating the level of impact partograph use has on care provision and referrals as well as on specific labor outcomes. Hence, if positive outcomes from partograph use are observed and informed to all involved in the birthing process, then certainly it will be embedded into routine labor ward practice.

Paperless Partograph

Even after the WHO simplified the partograph, it is rarely used in rural parts of India. 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.

Dr. A.K Debdas from India has proposed a new low-skill method called paperless partogram to adapt to local needs [28]. In the paperless partograph, the birth attendant calculates two times, an ALERT ETD (estimated time of delivery) and an ACTION ETD.

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.

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

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 [29].

The device, which incorporates traditional best practices and clinical algorithms from the paper partograph, facilitates broader use and expands the benefits of the paper-based version through the following improvements:

- Features efficient data entry, automatic plotting of observations
- Provides instant graphing of data
- Reminds providers when to measure and record critical observations
- Stores multiple patient data in one device
- Provides indicators when complications arise
- Limits retroactive data entry after delivery (a current practice that reduces the current paper partograph into a mere recording tool)

- Transmits data to off-site experts who can provide guidance and support

Jhpiego and JHU-CBID engineers are working with end-users to refine the device interface and gather data about user needs and preferences for device improvements, manufacturing and additional field studies.

The Jiv Daya Foundation launched the India Maternal Health Initiative aimed to strengthen hospital based care of mothers and newborns during labor and delivery and partnered with over 15 hospitals all over India [30]. The Foundation has devised an electronic partograph system to facilitate the early detection of labor abnormalities and initiation of timely interventions, as unmanaged complications often result in preventable death.

Mobile Partograph

Founded in 2002 out of MIT's Media Lab, Dimagi is a software social enterprise that develops technologies to improve service delivery in underserved communities.

Through an iterative process of user-focused design, Dimagi's technology aims to reduce the partograph's barriers by focusing on improving interpretability, applicability, time, and minimizing complexity. The mobile partograph acts as a job aid by prompting intrapartum care providers to report the necessary information at the appropriate time while calculating and producing timely reports on labor status.

Health clinics receive partographs that are filled out after the labor, and data take too long to reach decision makers such that up-to-date statistics are not always available. Real-time data reporting enables supervisors to detect data irregularities and observe whether recommended actions were taken, including identifying providers whose clinical practices in labor monitoring and management need improvement. Live partograph reports enable district health centers and health authorities to view and monitor complete labor records, including the full computer-plotted partograph. Monthly and quarterly reports allow health administrators to assess labor monitoring, timely provision of care for abnormal labors, and maternal and fetal health outcomes. Key alerts on emergency action can be sent to supervisors, and/or referral facilities, who can provide immediate backup support on appropriate next steps.

Many intrapartum care providers find the paper partograph challenging to fill in and see it as a burden rather than a job aid, filling it out retrospectively. Easy input of labor monitoring data (e.g., cervical dilation, fetal heart rate, status of membranes, amniotic fluid, etc.) in alphanumeric form improves usability as compared to paper-based form. Data are displayed in graphical or nongraphical format for use by a wide range of health workers. Minimal

training is needed due to embedded training videos and quizzes. An integrated library of obstetric clinical protocols, such as WHO and national guidelines, prompts information entry at appropriate times. Automatic alerts from data collected during labor and delivery facilitate workflow, and warnings when data entered fall beyond set parameters support intrapartum care providers to maintain data accuracy. Up-to-date information about available referral facilities informs decision-making to transfer a patient.

Dimagi launched this mobile partograph in India as a mobile application in both English and Hindi and was tried in few health-care facilities in 2015 [31]. Through this mobile application, key alerts on urgent emergency action are sent to supervisors, staff and/or referral facilities, who can provide backup advice on appropriate next steps by making immediate phone calls to providers. Monthly and quarterly reports are generated for health administrators to assess labor monitoring, timely provision of care for abnormal labors, and maternal and fetal health outcomes.

Recommendations for Clinical Practice

We would like to make the following recommendations for clinical practice:

- The partograph should be the main labor record, and a policy/guidance should be issued at all facility levels for health-care workers' reference.
- The modified partograph is more user-friendly as compared to the composite partograph.
- The partograph and the accessory equipment needed for its completion should be provided in all labor wards.
- Effective supervision by health-care workers/managers with training and clinical experience in partograph use is necessary for sustaining successful implementation.
- Regular training and updating should be provided for all health-care workers using the partograph, using proven effective training techniques, e.g., multidisciplinary, practical/clinical application.
- Training should include understanding of when to commence the partograph, decision-making based on findings and understanding of role.
- Monitoring and audit of the partograph in practice, including completion, decision-making and referral and outcomes, are recommended.

Conclusion

Competent use of the partograph can save maternal and fetal lives by ensuring that labor is closely monitored and that life-threatening complications such as obstructed labor

are identified and treated. To address the challenges for using partograph among health workers, health-care systems must establish an environment that supports its correct use. Health-care staff should be updated by providing training and asking them about the difficulties faced at their health center. Then only the real potential of this wonderful tool will be maximally utilized.

Compliance with Ethical Standards

Conflicts of interest The authors declare that they have no conflict of interest.

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