Original Article

# Evaluation of the alert line of partogram in recognizing the need for neonatal resuscitation

*Nahid Bolbol-Haghighi[1], Maryam Keshavarz[2], Mehri Delvarianzadeh[3], Sahar Molzami[4]*


## Abstract

**Background:** A major problem of the first moments of childbirth, especially in "prolonged labor," is perinatal asphyxia which necessitates neonatal resuscitation. This study aimed at evaluating the alert line of the partogram in recognizing the need for neonatal resuscitation 20–30 s after delivery.

**Materials and Methods:** 140 full-term pregnant women were kept under surveillance through using a partogram. In order to decide on the onset of resuscitation, the three indicators of fetal respiration, heart rate, and skin color were used 20–30 s after delivery. The findings from the evaluation of fetal conditions were compared to the position of the ultimate cervical dilatation graph to the alert line of the partogram, and through using appropriate statistical procedures, sensitivity, specificity, and positive and negative prediction values of the alert line to recognize the need for neonatal resuscitation were computed.

**Results:** There was a significant relationship between the need for neonatal resuscitation within 20–30 seconds after delivery and the graph of the cervical dilatations on the partogram ($P$ = 0.001). The indices of the alert line for predicting the need for resuscitation 20–30 s after birth had a sensitivity of 97.5%, specificity of 80.2%, positive prediction value of 97.2%, and negative prediction value of 98.7%.

**Conclusions:** In mothers who had normal vaginal delivery, with normal fetal heart rate, and with no oxytocin administration or omniotomy, the alert line showed appropriate sensitivity, specificity, and negative prediction value. So, it can assist in predicting the necessity of action for neonatal resuscitation 20–30 s after delivery.


**Key words:** Alert line, Iran, negative prediction value, partogram, positive prediction value, sensitivity, specificity

## Introduction

Birth is a graceful and miraculous, but, at times, the most hazardous event in a person's life.[1] The extensive prevalence of perinatal asphyxia in developing countries and the significant role it plays in increasing fetal mortality and morbidity indicate that its prevention needs to be set among the top priorities in maternal and fetal healthcare programs.[1,2] According to statistics published in 2005 by the World Health Organization (WHO), in developing countries, perinatal asphyxia and lack of oxygen caused 21% of the 4 million deaths of newborns who died within the first 28 days after birth, and birth injuries caused more than a third of these deaths. Moreover, obstructed and hard labor increased the odds of postnatal death up to five times.[3]

The statistics of the WHO in 2011 indicated that in Iran, the maternal mortality rate due to pregnancy and delivery complications was 30 in every 100,000 cases and the neonatal mortality rate was 21.8 in every 1000 live births. This is while many of these deaths were caused by weak labor monitoring and management which could be prevented through appropriate referencing or through simple and inexpensive interventions that were easily available.[4,5]

The abnormal labor progress with a prevalence of 17.2–2.6% in the world is the cause of 8% of maternal mortality in developing countries and is the commonest reason

[1]Department of Midwifery, Faculty of Nursing and Midwifery, Shahroud University of Medical Sciences, Shahroud, Iran, [2]Department of Midwifery, Faculty of Nursing and Midwifery, Tehran University of Medical Sciences, Tehran, Iran, [3]Department of Public Health, Faculty of Health, Shahroud University of Medical Sciences, Shahroud, Iran, [4]Department of Laboratory Sciences, Islamic Azad University, Shahroud Branch, Shahroud, Iran.

**Address for correspondence:** Mrs. Nahid Bolbol-Haghighi, Department of Midwifery, Faculty of Nursing and Midwifery, Shahroud University of Medical Sciences, Shahroud, Iran.
E-mail: nbhaghighi349@yahoo.com

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for early cesarean delivery operations.[6,7] Early diagnosis of the abnormal progress of labor helps appropriate decision-making, taking timely medical and pharmaceutical interventions, and reference to higher level care facilities, and it can lead to improvement of maternal and fetal health. To achieve this aim, various graphical representations of cervical dilatations and fetal descents have been suggested.[8,9]

One of these graphic models developed by the WHO in 1980 is the partogram, which was recommended to the developing countries to prevent any abnormal event during labor. The partogram is a reliable tool for monitoring maternal and fetal conditions and labor progress, and it is an alerting system for early diagnosis of labor problems.[10,11] The partogram is a tool that provides a continuous pictorial overview of labor, and is essential to monitor and manage labor. The partogram divides labor into two stages of latent phase and active phase. The latent phase starts with cervical dilatations of 0–3 cm, with the upper time limit of 8 h. The active phase starts with cervical dilatations of 3–10 cm during which labor progress is plotted on the partogram which has preprinted alert and active lines. In case of appropriate labor progress, the graph of cervical dilatation lies to the left or on the alert line. A cervical dilatation graph which lies on or to the right of the active line indicates delayed labor and necessary measures need to be taken.[12-14]

Javed and colleagues (2007) carried out a study on 1000 women in labor to determine the effect of partogram on the frequency of prolonged labor, augmented labor, operative deliveries, and to find whether appropriate interventions based on the partogram will reduce maternal and perinatal complications. In their research, 91.6% of deliveries occurred within 12 h; 88% were normal vaginal deliveries, 5.6% were instrument-assisted deliveries, and 6.4% were cesarean deliveries.[11] Lavender and colleagues (2006) found that the use of partogram resulted in no change in the rate of cesarean delivery, instrument-assisted delivery, or in newborns' Apgar scores. Rather, higher amount of oxytocin was needed to augment labor. So, they did not recommend using partogram for making decisions on labor progress.[15] The WHO reports that the use of partogram leads to a decrease in prolonged labor and its complications, maternal and fetal mortality and morbidity, cesarean delivery rate, labor induction, financial costs, and surgical intervention.[12] Moreover, the alert line on the partogram is an indicator which helps predict the need for neonatal resuscitation.[16] Despite the positive results obtained with partogram use in labor management and the WHO recommendations,[9] in many parts of the world and especially in Iran, partogram is not practically used and there are disagreements over the appropriate time of intervention in labor. Noting this, this research intended to evaluate the use of the alert line of the partogram in recognizing the need for neonatal resuscitation 20–30 s after birth.

## Materials and Methods

In this cross-sectional study, all eligible full-term pregnant women admitted to the maternity wards of hospitals in Shahroud ($N = 140$) in 2011 were selected. All participants were aware of the study goals. The inclusion criteria were singleton pregnancy, fetal head display, zero to third delivery, maximal cervical dilatation of 3 cm upon admission, normal heart rate, no history of medical, surgical, or midwifery problems, no history of taking analgesic drugs during pregnancy, and no congenital fetal problems. The data collection instruments included a questionnaire, a partogram, and resuscitation actions form. The questionnaire had four sections. The first demographic section included items on maternal age, weight, height, occupation, etc. The second section included items on the maternal condition upon admission, such as cervical dilatation, the amount of fetal head decent, the status of fetal head, and the number and length of uterus contractions. The third section dealt with labor progress and included items on the length of labor, the length of second phase of labor, amount of fetal head decent, and cervical dilatations to the right of alert line and action line. The fourth section dealt with fetal information and included items on newborn's weeping, respiration, heart rate, skin color, and Apgar scores at 1$^{st}$, 5$^{th}$, 10$^{th}$, 15$^{th}$, and 20$^{th}$ minute after birth. On the partogram, labor progress indicators such as cervical dilatation, and alert and action lines, the amount of fetal head decent, and uterus contraction specifications were recorded. On this chart, fetal condition was determined using indicators such as heart rate, the status of amniotic sac, the color of the fluid (in case of membrane rupture), and the position of fetal skull bones.

Maternal condition was also assessed using indicators such as recording pulse rates at 3 h intervals, blood pressure and temperature at 4 h intervals, analysis of maternal urine in terms of volume, protein, and acetone at 2–4 h intervals, and use of medicines and intravenous liquids prescribed by the researcher. In case of long latent labor phase and second labor phase or in case the cervical dilatation graph lay to the right of the alert and action lines, active interventions such as supporting treatment, oxytocin administration, and rupturing fetal membrane were taken and the labor was ended, and one of the staff with a bachelor's degree in midwifery delivered the baby. The use of a trained midwifery for evaluation and delivery can reduce the intra and interobserver biases.

After delivery, a chronometer was used and the onset of neonatal resuscitation was decided upon with three

signals of neonatal respiration, heart rate, and skin color. To evaluate the newborn's conditions and resuscitation attempts, the Apgar score was used. If the 5th minute Apgar score was less than 7, the resuscitation measures were continued for 20 min and, meanwhile, the Apgar scores were measured every 5 min. This trend continued until the Apgar score in the two phases reached 8, and other monitoring actions were taken by the nursing personnel.

At the end, the findings from the neonatal conditions were compared to the ultimate graph of maternal cervical dilatations and its position to the alert line on the partogram recommended by the WHO. The data were analyzed using Student's *t*-test (for continuous variable) and Chi-square test (for dichotomous variable). SPSS software was used.

## Ethical considerations

All participants signed an informed consent form. The research proposal was approved by the Committee of Research in Shahroud University of Medical Sciences (No. 8929).

## Results

The mean age of mothers participating in the study was 23.9 ± 4.9 years and the mean gestational age was 39.7 ± 6.92 weeks. The mean dilatation of cervix at the start of the study was 2.5 ± 0.72 cm.

As the partogram showed, the cervical dilatation graphs of 68.6% ($n$ = 96) of pregnant women were to the left or on the alert line and those of 28.6% ($n$ = 40) were to the right of the alert line. In 2.9% ($n$ = 4) of the mothers, the cervical dilatation graphs were to the right or on the action line [Figure 1]. The results showed that there was a significant relationship between the need for neonatal resuscitation 20–30 s after birth and the position of the cervical dilatation graph ($P$ = 0.001). That is, the babies of 19.8% ($n$ = 19) of mothers with cervical dilatation graphs to the left or on the alert line required neonatal resuscitation, while for mothers with cervical dilatation graphs to the right of the alert line, this figure stood at 97% ($n$ = 39) [Figure 2].

The results of this study indicated that the value of the alert line for prediction of the need for neonatal resuscitation 20–30 s after birth had a sensitivity of 97.5%, specificity of 80.2%, positive prediction value of 97.24%, and negative predication value of 98.7%. These results indicated that the value of alert line for prediction of the need for neonatal resuscitation 20–30 s after birth had high sensitivity and specificity. The results also indicated that the value of the alert line for prediction of the need for neonatal resuscitation 20–30 s after birth in mothers with normal delivery, normal neonatal heart rate, without oxytocin administration, and no amniocentesis had a sensitivity of 100%, specificity of 88%, positive predictive value of 62.5%, and a negative predictive value of 100%. The results also showed a positive relationship between delivery mode, fetal heart rate, oxytocin administration, and the position of the cervical dilatation graph. That is, the rates of abnormal labor, abnormal fetal heart rate, and oxytocin administration were greater when the alert line was to the right of the alert line [Table 1].

## Discussion

The results of this study show that the cervical dilatation graphs of 68.6% of the studied pregnant women were to the left or on the alert line and those of 28.6% were to the right of the alert line or on the action line. In a study, Diarra and colleagues (2010) reported that 64% of cervical dilatation graphs were to the left or on the alert line and 31.3% were to the right of the alert line. In 4.7% of the cases, the graphs were on or to the right of the action line.[17] The WHO (1994) used the partogram to study

**Table 1: Frequency distribution of abnormal labor, abnormal fetal heart rate, and oxytocin administration according to cervical dilatation graph**

| Plot position / Standard | To the left of the alert line | | To the right of the alert line | | Significance value ($P$) |
|---|---|---|---|---|---|
| | $n$ | % | $n$ | % | |
| Abnormal labor | 3 | 3.12 | 7 | 17.5 | 0.005 |
| Abnormal fetal heart rate | 11 | 11.45 | 15 | 37.5 | 0.001 |
| Oxytocin administration | 7 | 7.3 | 14 | 35 | 0.0001 |

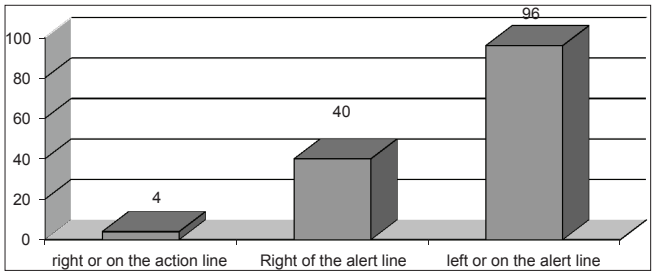


**Figure 1:** Frequency distribution of participants according to the position of cervical dilatation graph

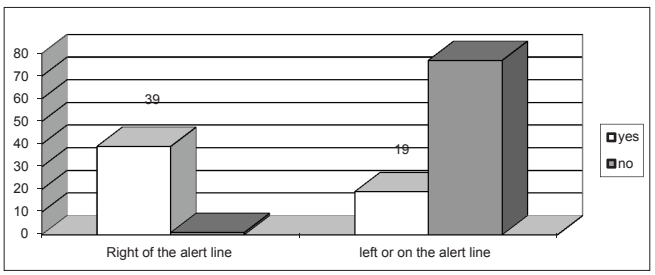


**Figure 2:** Frequency distribution of the need for neonatal resuscitation according to the maternal cervical dilatation graph

labor monitoring in hospitals in Southeast Asian countries including Indonesia, Thailand, and Malaysia and reported that the cervical dilatation graphs of 72.8% of mothers were to the left or on the alert line, 17.3% were to the right of the alert line, and 9.9% were on or to the right of the action line.[18] The results of the two above-mentioned studies are consistent with the present findings. In a study by Ogwang and colleagues (2009), 13 cervical graphs crossed the action line, which is in accordance with our findings.[19]

In this study, a significant relationship was observed between delivery mode, fetal heart rate, and oxytocin administration, and the position of the cervical dilatation graph. Reporting on similar studies, the WHO (1994) found that when cervical dilatation graphs were on or to the right of the action line, there were 65.3% of labor stimulations and 21.7% of cesarean deliveries.[18] This finding is not in accordance with the our finding on labor stimulation, which may be due to the more active labor management (oxytocin-augmented labor) in that study which led to reduction in the number of normal deliveries.

Vandana and colleagues[20] showed 16% primi in zone A (to the left of the alert line) delivered by cesarean section, as compared to 5% multigravidae. Also, 75% primi delivered vaginally and 30.6% required intervention, and among multigravidae, 95% delivered vaginally and 16.8% required intervention. This finding is not in accordance with our finding, which may be because half of the primi patients were admitted at 1 finger cervical dilatation and lower station of fetal head and the multigravida patients had 2–3 cm dilatation and higher station on admission.[20] This finding is not in agreement with our finding, which may be due to the pilot and initial studies conducted for evaluating the alert line which caused a rise in instrument-assisted delivery.

Windrim and colleagues (2007) maintained that using a partogram without supervision by a superior could not decrease the rate of cesarean delivery and midwifery interventions including amniotomy, oxytocin administration, etc.[21] Lavender and colleagues (2009) obtained similar results[22] which are in line with our findings.

The results of the present research showed a significant relationship between the need for neonatal resuscitation 20–30 s after birth and the position of the cervical dilatation graphs, and the value of the alert line for predicting the need for neonatal resuscitation 20–30 s after birth to the 1st minute Apgar score had a high specificity and high positive and negative prediction values. Dujarian and colleagues (1992), in their study, reported the sensitivity, specificity, and positive prediction value of the alert line for the need of neonatal resuscitation to be 27%, 93%, and 17%, respectively.[23] This finding is not consistent with our finding, which may be due to the fact that they considered the 1st minute Apgar score for the need for neonatal resuscitation, but we computed the need for neonatal resuscitation based on the three factors of respiration, heart rate, and skin color within 20–30 s after birth. Their finding, however, is in line with ours in terms of the specificity of the alert line with the 1st minute Apgar score. Ogwang and colleagues (2009) found a significant relationship between the dilatation of cervix and crossing action line, and bad fetal outcomes.[19] Roosmalin (1989) believed that using the partogram in labor monitoring prevented prolonged labor and caused timely diagnosis of fetal distress and reduction of stillbirth and fetal mortality.[21,24] Rocha and colleagues (2009)) performed a comparative analysis between the partogram zones in their study. They did not show any statistical significance in terms of the Apgar score in the 1st or 5th minute of life. No Apgar scores lower than 7 were found in zone III (when the action line is crossed), either in the 1st or in the 5th minute.[25]

The extensive prevalence of perinatal asphyxia in developing countries and the significant role it plays in increasing fetal mortality and morbidity indicate that its prevention needs to be set among the top priorities in maternal and fetal healthcare programs. Doing antepartum monitoring and using a partogram for intrapartum monitoring, early diagnosis of labor problems, and theoretical and practical readiness for "neonatal resuscitation," and availability of suitable equipment in the delivery room, can help to prevent perinatal asphyxia.

## Conclusion

With regard to the ultimate aim of the research, we found that in mothers who had normal vaginal delivery, with normal fetal heart rate, no oxytocin administration, and without amniotomy, the need for neonatal resuscitation 20-30 s after birth had appropriate sensitivity, specificity, and negative prediction value.

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