

Predictive Value of Cervical Dilatation at Initial Presentation in Labor and Subsequent Intervention

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ABSTRACT

Background: The development of initiatives to lower caesarean section rates requires a fundamental understanding of the dynamics of normal and atypical labor, as well as women's behavior.

Objective: The aim of the current study is to assess the predictive value of initial cervical dilatation at the time of hospital admission in nulliparous women in labor and its relation to subsequent intervention, mode of delivery, and maternal, fetal outcomes.

Patients and methods: This cohort study was conducted at the Department of Obstetrics and Gynecology of both Menoufia University Hospital and Quesna General Hospital included 60 nulliparous pregnant women with singleton cephalic deliveries at 36-42 weeks who were admitted in spontaneous labor at various grades of cervical dilatation < or equal 6 cm. **Results:** There was a significant difference between the Average Dilatation Rate (ADR) and Initial Dilatation Rate (IDR) and the number of vaginal examinations and duration of 1st stage and a highly significant difference in the duration of 2nd stage. While correlating with the mode of delivery, we found that ADR is 1cm/h or more 100% in the spontaneous vaginal group and 80% in the assistant vaginal group while it is 100% less than 1cm/h in the cesarean group. IDR is 1cm/h or more in 88.6 % of the spontaneous vaginal group and less than 1cm/h in 100% of assistant vaginal and 100% of cesarean groups.

Conclusion: The IDR appears to be an accurate indicator and predictor of the course of labor. When IDR was 1cm/hour or more percentage of vaginal delivery was more and if less than 1cm/hour percentage of CS was more.

Keywords: Average dilatation rate, Cervical, Initial dilatation rate, Labor, Pregnancy.

INTRODUCTION

The physiological progression of labor and the differentiation between physiological and non-physiological labor have recently received attention in obstetrical research, particularly to minimize caesareans and improve labor management [1].

These efforts led to the creation of the Partograms by Friedman, Hendricks, and Philpott. An established instrument for monitoring labor progress is a partogram. A partogram's usage is linked to better treatment quality and labor outcomes, according to a number of studies [2-4].

Friedman's work from the 1954s served as the foundation for the widely used WHO partogram, which has since been updated and updated labor curves evaluated. Friedman created a cervical dilatation time curve that allowed for important labor progression monitoring [2,5].

Hendricks, however, sparked resurgence in interest for partograms, notably with cervicograms. Cervicograph upkeep throughout labor is very beneficial in the treatment of challenging patients [6]. In the early detection of slowly progressive labor dystocia, partograms are particularly helpful. By retrospectively evaluating the nomograms of a primigravida in labor, the study discovered that nomograms are helpful in discriminating between normal and abnormal labor [1]. Ledger claims that an aberrant cervical dilation pattern suggests the necessity for a clinical examination and potential intervention, but does not define the course of treatment [7].

Cervicographs are the primary component of Partograms, according to Philpott and Castle. Their alarm line notifies the obstetrician to provide the patient with prompt treatment, such as moving to another well-equipped hospital or initiating an oxytocin drip, among other things. Active management is typically needed when the cervicographs pass the action line. Obstetricians in practice get the ability to spot the early indicators of atypical labor via practice [8].

Initial dilatation rate (IDR) measures' main benefit is their ability to accurately identify births that might pose a concern. 100% of pregnancies ended in vaginal births, either naturally or with some help, when the IDR was 1 cm/hr or above. With an IDR of 1 cm/hour or more, 96% of primiparas spontaneously gave birth, whereas 60.5% needed assistance or a caesarean section with an IDR of less than 1 cm/hour [4].

Therefore, examining the cervix during labor might reveal important details about how labor is developing and what is likely to happen next. Together, the pace of cervical dilatation and the descent of the presenting section provide the most reliable indicator of labor productivity. It appears that the early rate of cervical dilatation is a reliable indicator of how labor will progress. The first dilatation rate provides an early indicator of potential labor complications [5].

Thus, we aimed to assess the predictive value of initial cervical dilatation at the time of hospital admission in nulliparous women in labor and its relation to

subsequent intervention, mode of delivery, and maternal, and fetal outcomes

PATIENTS AND METHODS

This cohort study was conducted at the Department of Obstetrics and Gynecology of both Menoufia University Hospital and Quesna General Hospital, and included 60 nulliparous pregnant women who were admitted in spontaneous labor at various grades of cervical dilatation \leq or equal 6 cm.

Sample size calculation: Based on previous studies the multiple regression analysis for predictors of the rate of dilatation to be 0.72, the sample size has been calculated at 80% power and 95% confidence interval and it will be 60 participants.

Inclusion criteria were Nulliparous pregnant women aged from 19-30 y with gestational age from 36-42 weeks were medically and obstetrically normal; Height not less than 150cm and BMI not more than 30; viable singleton pregnancy; Vertex presentation; No medical diseases or obstetric disorders; Patients in labor with cervical dilatation less than or equal 6cm; Intact membrane.

Exclusion criteria were women who were medically or obstetrically at risk (Vaginal bleeding, congenital uterine anomalies, oligohydramnios or polyhydramnios); patients with cephalopelvic disproportion diagnosed clinically by clinical evaluation of the pelvis and sonographic examination of the fetal head size; patients diagnosed with malposition (occiput posterior) as diagnosed by vaginal examination with the advance of labor; IUFD; Intrapartum complications that require immediate cesarean section as fetal distress, intrapartum bleeding, cord presentation, or prolapse; Women scheduled for induction of labor; Patients in labor with cervical dilatation more than 6cm or fully dilated cervix; Premature rupture of membrane; Previous uterine scar.

All the included study participants undergo thorough history taking, general, abdominal examination, and local examination: Routine investigations: complete blood picture, blood group, RH typing, and random blood sugar. The local examination includes the degree of cervical dilatation, cervical effacement, cervical consistency, position, state of membranes, station of the fetal presenting part, and pelvic adequacy.

If the last menstrual period was verified by a first-trimester ultrasound examination, the gestational age is calculated based on it, or by ultrasound alone if the sonographic estimate of gestational age in the first trimester differed from the menstrual date by more than one week.

Once labor had begun and the cervical dilatation had reached 1 cm or more, the course of the dilatation was observed. When there are regular uterine contractions, the active phase of labor is defined as 4 to 10 cm of cervical dilation (3-5 contractions per 10 minutes).

Women in labor were admitted at different degrees of cervical dilatation \leq or equal to 6cm. Dilatation is assessed digitally and expressed in centimeters every 2 hours or if necessary, at shorter intervals.

Some participants started taking nalbuphine (nalufin) 20 mg IM at the start of the active phase of labor. Repeat doses were only given if two hours had passed since the previous one, with a maximum of three doses.

We collected information on the number of hours needed to acquire 1 cm as labor continues to 10 cm in order to detect patterns of cervical dilatation (i.e. the traverse time from 2 to 3 cm, 3 to 4 cm, etc.), to evaluate possible variations in labor trends depending on admission cervical dilation.

When the laboring woman becomes progresses in labor, artificial rupture of the membrane is done by a sterile amniotome or digitally by finger.

Women who had a cervical dilation of at least 4 cm and a poor progress of labor (pause of cervical dilatation of ≥ 2 hours with insufficient uterine activity) began augmentation of labor with oxytocin. Once effective contractions were attained, oxytocin augmentation was begun with an intravenous infusion of 2 m IU/min (5 units in 500 ml of normal saline at a rate of 4 drops/min) and doubled every 30 minutes (three or four contractions lasting at least 40 seconds per 10 minutes). 32 m IU/min of oxytocin was the highest dosage.

When a study participant developed other causes of cesarean delivery during her labor follow up such as fetal distress and abruptio placentae when it associated with maternal hemodynamic instability, non-reassuring fetal heart rate pattern. She is excluded from the study.

The first measurement after two hours is used to determine IDR, which is based on the rate of rise of cervical dilatation starting with cervical dilatation at the first presentation of labor and ending with that measurement. The pace of rising cervical dilatation from the beginning of initial presenting cervical dilatation to complete cervical dilatation is known as the average dilatation rate (ADR), which is computed based on further repeated tests. All research groups had continuous observation for uterine contractions, a descent of the presenting portion, maternal and fetal health, and labor progress, which was documented in a modified WHO partogram.

If labor progressed at the anticipated rate of dilatation, the management of the women who were randomly allocated to different groups was unchanged. However, a clinical assessment was performed to determine the kind of intervention for the management of the delayed progress if the cervical dilatation rate dropped on or crossed the action line. When augmentation was necessary, this entailed either amniotomy followed by oxytocin in the presence of intact membranes or oxytocin alone when membranes were ruptured.

By employing handheld Doppler instruments, intermittent auscultation was used to track the fetal heart rate. The fetal heart rate was measured immediately following a contraction for at least 1 minute every 30 minutes throughout the first stage, and then every 15 minutes during the second stage, in the absence of any anomalies [9]. If intermittent auscultation reveals potential fetal heart rate anomalies, cardiotocography was employed. If the trace was normal after 20 minutes, it was withdrawn, and intermittent auscultation was resumed. If oxytocin was necessary, continuous foetal monitoring was employed [10].

Epidural analgesia was not used because it was not used liberally in our department and to decrease variables operated in this sample. Cesarean section was done during the first stage in cases of fetal distress even after (repositioning of the patient, stoppage of oxytocin, and giving oxygen) if secondary arrest persists after 2 hours or no descent for one hour during the expulsive phase of the second stage.

The research group was then separated into groups based on the birth method (spontaneous vaginal delivery, aided vaginal delivery, or caesarean delivery), as well as the grades of initial cervical dilation at the time of hospital admission, group I latent phase (cx. dilated 1-3cm) group II active phase group (cx. dilated >or equal 4cm).

The main results were the capacity to predict initial cervical dilation (IDR) and average cervical dilatation rate (ADR) for delivery methods that provide a linear cervical dilatation rate from the whole labor time without defining the patterns of labor progression during the first stage. The distribution method used was (spontaneous vaginal delivery, instrumental delivery & caesarean section). The secondary outcomes included, expected time intervals by the cervical dilatation stage from one centimeter to the next one, and the amount of time needed to get from one degree of cervical dilatation to another.

Demographic and obstetric factors which affect cervical dilatation, maternal outcomes: Need for oxytocin augmentation, need for the performance of artificial rupture of membranes, Requirement of analgesia. Number of vaginal exams, length of the first stage of labor, and the second stage of labor neonatal

results At 1 and 5 minutes, the Apgar score was below 7, and special care neonatal unit admission.

The collected data were studied and cases were divided into two groups:

The latent phase group (group I) with cervical dilatation at admission is (1-3) cm.

The active phase group (group II) with cervical dilatation at admission is more than or equal to 4cm.

Ethical consent:

An approval of the study was obtained from Menoufia University Academic and Ethical Committee. After explaining our research objectives, written informed consent was obtained from all study participants. This study was conducted in compliance with the code of ethics of the world medical association (Declaration of Helsinki) for human subjects.

Statistical analysis:

SPSS statistical software version 23 (SPSS Inc., 2015) was used on an IBM-compatible personal computer to compile, tabulate, and statistically analyze the results (Armonk, NY: IBM Corp., IBM SPSS statistics for Windows, version 23.0). Data were tested for normal distribution using the Shapiro-Walk test. Qualitative data were represented as frequencies and relative percentages. Chi-square test (χ^2) was done to calculate difference between two or more groups of qualitative variables. Quantitative data were expressed as mean and standard deviation (SD). Independent samples t-test/Mann-Whitney test and ANOVA test/Kruskual wallis test were used to compare between two or more independent groups of quantitative variables (parametric and non-parametric data). A correlation between two continuous properly distributed variables was demonstrated using Pearson correlation. P-value ≤ 0.05 was considered significant.

RESULTS

In our study, there was a significant difference between groups as regards ADR ($P < 0.05$) and there is a highly significant difference between groups as regards IDR ($P < 0.001$) (Table 1).

Table 1: Comparison between ADR and IDR of the studied groups.

Variables	Group I No=39	Group II No=21	Test of the sign.	P value
ADR Mean \pm SD	1.15 \pm 0.20	1.65 \pm 0.32	t 2.99	0.004*
IDR Mean \pm SD	0.78 \pm 0.18	1.24 \pm 0.30	t 4.40	<0.001**

IDR: Initial dilatation rate. ADR: Average dilatation rate. t: student test.

Table 2 compares ADR and IDR regarding the mode of delivery. There were highly significant differences between mode of delivery of the studied groups as regard as ADR and IDR.

Table 2: ADR and IDR in the studied groups, and mode of delivery.

Variables	Group I				Group II		
	Spontaneous vaginal No=17	Assisted vaginal No=10	CS No=12	Test of sig P value	Spontaneous Vaginal No=18	CS No=3	Test of sig P value
ADR Mean \pm SD	1.72 \pm 0.37	1.08 \pm 0.17	0.400 \pm 0.09	F= 33.7 P <0.001	1.86 \pm 0.34	0.400 \pm 0.01	t= 7.2 P <0.001
IDR Mean \pm SD	1.11 \pm 0.26	0.57 \pm 0.13	0.49 \pm 0.11	K= 27.7 P <0.001	1.37 \pm 0.22	0.46 \pm 0.05	t= 6.9 P <0.001

F: One way ANOVA test. K: Kruskal wallis test. IDR: Initial dilatation rate. ADR: Average dilatation rate. t: student test.

According to the frequency distribution of initial dilatation rate and delivery outcome, our results reported that the highest incidence of C.S was observed in cases with IDR less than 0.5cm/hr, where the incidence of C.S was nil when IDR was 1cm/hr or more and maximum proportion delivered spontaneously (**Table 3**).

Table 3: Frequency distribution of initial dilatation rate and delivery outcome.

Initial dilatation rate (cm-hr)	Spontaneous vaginal delivery %	Assisted vaginal delivery %	Cesarean section %
0.00-0.49	-	10%	53.3%
0.50-0.99	11.4%	90%	46.7%
1-1.49	60%	-	-
1.50 or more	28.6%	-	-
Total	100.0	100.0	100.0

As regards the Correlation between ADR and IDR and secondary parameters, we reported that highly significant difference between ADR and IDR and the need for oxytocin ($P < 0.001$). There is a significant difference between ADR and IDR and the need for analgesia ($P < 0.05$) (**Table 4**).

Table 4: Correlation between ADR and IDR, and other parameters.

Variables	ADR Mean \pm SD	Test of a sign. P-value	IDR Mean \pm SD	Test of a sign. P-value
Need for oxytocin				
• Yes	1.71 \pm 0.47	U= 3.73	1.18 \pm 0.37	t= 4.31
• No	1.08 \pm 0.65	P <0.001**	0.79 \pm 0.41	P <0.001**
Need for analgesia				
• Yes	1.17 \pm 0.57	U= 1.64	0.82 \pm 0.38	t= 1.92
• No	1.45 \pm 0.71	P= 0.053*	1.03 \pm 0.46	P= 0.030*
Membrane rupture				
• Spontaneous	1.35 \pm 0.66	U= 0.328	0.94 \pm 0.44	U= 0.032
• Induced	1.30 \pm 0.67	P= 0.372	0.95 \pm 0.44	P= 0.487

*Significant. ** high significant. U= Mann-Whitney test. t= Students t-test. IDR: Initial dilatation rate. ADR: Average dilatation rate.

On Correlation between ADR and IDR, and secondary parameters, we found that significant difference between ADR and IDR and the number of vaginal examinations & duration of 1st stage ($P < 0.05$) there's a highly significant difference between ADR and IDR and the duration of 2nd stage ($P < 0.001$) (**Table 5**).

Table 5: Correlation between ADR and IDR, and other parameters.

Variables	ADR		IDR	
	r	P value	r	P value
Number of vaginal examinations	-0.005	0.972	-0.279	0.031*
Duration of the first stage	-0.069	0.600	-0.345	0.007*
Duration of 2nd stage	-0.531	<0.001**	-0.738	<0.001**

*Significant. ** Highly significant. r= Pearson correlation. IDR: Initial dilatation rate. ADR: Average dilatation rate.

As regards the correlation between ADR and IDR, and mode of delivery, our study reported that ADR is 100% 1cm/h or more in the spontaneous vaginal group and 80% in the assisted vaginal group while it is 100% less than 1cm/h in CS group IDR is 1cm/h or more in 88.6% of spontaneous vaginal group and less than 1cm/h in 100% in assisted vaginal and 100% in CS groups (**Figure 1**).

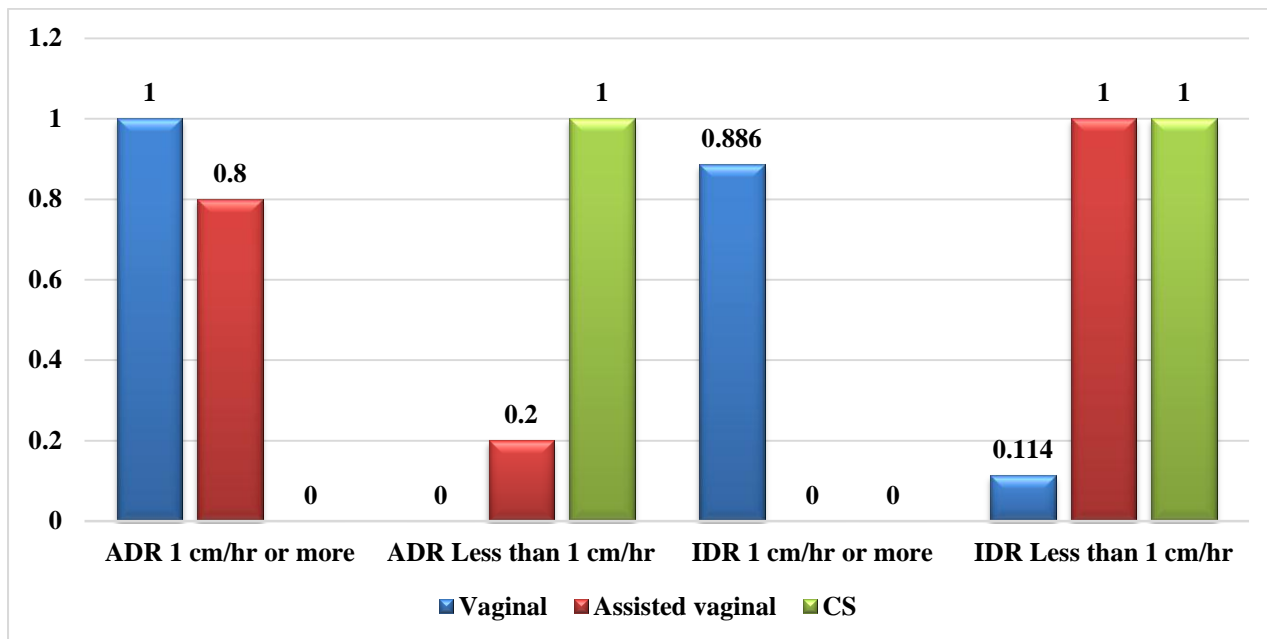


Figure (1): Correlation between ADR and IDR, and mode of delivery.

DISCUSSION

Our study showed a significant difference between groups as regards ADR ($P < 0.05$) high significant difference between groups as regards IDR ($P < 0.05$). Our study showed that ADR is 100% 1cm/h or more in the spontaneous vaginal group and 80% in the assisted vaginal group while it is 100% less than 1cm/h in C.S group, IDR is 1cm/h or more in 88.6% of spontaneous vaginal group and less than 1cm/h in 100% in assisted vaginal and C.S group. In primigravida labor, **Leveno et al.** ^[11] discovered that an IDR of 1 cm/hr or greater led to 100% vaginal deliveries, either naturally or with some help. While 60.5% of primiparas required assistance birth or a caesarean section with an IDR of less than 1 cm/hr, approximating the current study, 96% of primiparas delivered naturally with an IDR of 1 cm/hr or higher.

Our study showed that cases of group 1 with a mean ADR is 1.72 need NVD, was 1.08 in assisted vaginal delivery and 0.4 in CS, while cases of mean IDR was 1.1 need NVD it was 0.57 in assisted vaginal delivery and 0.49 in CS cases of group 2 with mean ADR was 1.86 need NVD, it was 0.4 in CS cases of mean IDR is 1.37 need NVD 0.46 in CS.

Leveno et al. ^[11] discovered that the mean first dilatation rate for primiparas in spontaneous, assisted, and caesarean section births, respectively, was 1.55 cm/hr, 0.91 cm/hr, and 0.39 cm/hr. 100% of births took place vaginally when the initial dilatation rate (IDR) was 1 cm/hr or higher; however, with an IDR of less

than 1 cm/hr (mean IDR of 0.93 cm/hr), 60.5% required assisted delivery or caesarean section.

Our study showed that the highest incidence of c.s was observed in cases with IDR less than 0.5 cm/hr where the incidence of CS was nil when IDR was 1cm/hr or more and the maximum proportion delivered spontaneously.

Our study showed that highly significant correlation between initial dilatation rate, average dilatation rate, and mode of delivery (spontaneous vaginal, assisted vaginally, and C.S) (P value < 0.001). According to **Leveno et al.** ^[11], patients undergoing caesarean sections had a mean IDR that was 74.8% slower than individuals undergoing vaginal births. Our findings is supported by the fact that, according to mean ADR calculations, the dilatation rates in the aided birth group and the caesarean delivery group were, respectively, 47.6% and 86.5% slower than the rates in the spontaneous delivery group.

Our study showed that highly significant difference between ADR & IDR and the need for oxytocin ($P < 0.001$), and a significant difference between ADR and IDR, and the need for analgesia ($P < 0.05$). Our study showed that significant difference between ADR and IDR, and the number of vaginal examinations and duration of 1st stage ($P < 0.05$). There was a highly significant difference between ADR & IDR and the duration of the 2nd stage ($P < 0.001$).

Our study did not find a significant difference between groups in maternal or fetal outcomes

($P>0.05$). According to Ngeby ^[12], lengthy labor results with a higher need for oxytocic medications, more caesarean sections, and less favorable fetal outcomes.

According to Wanyoike Gichuhi *et al.* ^[13], both groups' overall maternal outcomes were favorable. However, uterine atony and postpartum endometritis rates were twice as high in the latent phase group as they were in the active phase. Even after parity analysis, there was no discernible difference in the proportion of low birth weight babies between the early and late presenters in terms of fetal outcome.

Only substantially difference low Apgar scores at 1 minute were found in primigravid women. When parity was taken into consideration, there were no discernible differences between early and late presenters in terms of low Apgar scores at 5 minutes, admission of infants to NBU, or early newborn fatalities.

Our Strength of the study was every effort was made to ascertain that all follow-up data were correct. Assessment of study outcomes was done by the same observer.

The limitations of the study were limited maternal GA and BMI, together with limited inclusion of multiparous women and a large range of maternal age. The lack of information on the psychological differences between women hospitalized in early or late labor is one of the study's potential weaknesses.

CONCLUSIONS

The IDR appears to be an accurate indicator and predictor of the course of labor, when IDR was 1cm/hour or more percentage of vaginal delivery was more and if less than 1cm/hour percentage of CS was more. An IDR of 1cm/hr or more resulted in 100% vaginal delivery either spontaneous or with some assistance.

About 96% primiparas deliver spontaneously with an IDR of 1cm/hr or more while 60.5% required assisted delivery or cesarian section with an IDR of less than 1cm/hr. Large randomized studies are recommended to study the initial cervical dilatation and cervical dilatation rate in both nulliparous & multiparous women by using the new generation of WHO labor care guide (LCG) to assess labor progress.

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