

Progression of first stage of labor, in low risk nulliparas in South Asian Population: A prospective observational study

Roli Purwar¹, Sunita Malik², Zeba Khanam², Archana Mishra², shaodashi saxena³, preeti priyadarshini¹, and Pratima Mittal²

¹All India Institute of Medical Sciences

²Vardhman Mahavir Medical College and Safdarjung Hospital

³Era's Lucknow Medical College and Hospital

April 28, 2020

Abstract

Objective: To compare labor pattern at 4cm and 6 cm cervical dilatation in spontaneous labor in low risk nulliparous women. **Design:** A prospective observational study. **Setting:** The study was conducted in a tertiary referral center of India. **Population:** Study involved 500 low risk nulliparas; singleton term pregnancy; vertex presentation in spontaneous labor; cervical dilatation [?]4cm and no contraindications for vaginal delivery. **Methods:** Women were randomized into two groups A and B of 250 each, active phase considered at 4cm for group A and 6cm for group B. Labor duration was calculated and average labor curves were drawn. **Main Outcome:** To study the average labor pattern curve. **Results:** Mean duration of active phase from 4- 10 cm is 5.12 ± 2.01 hours and from 6-10 cm is 2.79 ± 1.72 hours. 95th percentile values suggest that it took 5-6hours in progression from 4-6 cm and again 5-6 hours from 6-10cm. The minimum labor progression rate can be as low as 0.5cm/hour, still vaginal delivery can be achieved. The slope of labor curve steepens after 6cm, suggesting 6cm as the onset of active phase. **Conclusion:** Allowing labor to continue for a longer period before 6 cm of cervical dilation may reduce the rate of unnecessary intrapartum intervention and caesarean section for labor dystocia. Large-scale studies further needed for standardization of cutoff values for differentiating normal from abnormal labor. **Funding:** We received no financial support for the research, authorship, and/or publication of this article. **Keywords:** labor duration, nulliparous women, labor pattern, active phase of labor

TWEETABLE ABSTRACT:

We compared the labor pattern at the active phase of labor defined at 4cm versus 6cm cervical dilatation in South Asian population. We found that labor can be as prolonged as 10-12 hours from 4cm, still women can achieve vaginal delivery. The slope of labor curve steepens after 6cm, suggesting 6cm as the onset of active phase. So, allowing labor to continue for a longer period before 6 cm of cervical dilation may reduce the rate of unnecessary intrapartum intervention and CS for labor dystocia.

MAIN TEXT

Dr Emanuel Friedman in the 1950s introduced labor curve and defined the normal and abnormal labor¹⁻³. His definitions of normal labor and abnormal labor are still widely accepted in current obstetric practices. The Friedman's normal dilatation rate of 1cm/hr that is universally accepted is becoming questionable in our current obstetric population because of escalating rates of unnecessary labor interventions like oxytocin augmentation and caesarean section^{4,5}. Recent studies also suggest that the active phase of labor does not start until 5-6 cm cervical dilatation has reached, and can be slower than it was historically described still women can achieve normal vaginal delivery⁶⁻⁹. There is also existing debate for this previously described labor pattern because of differences in race, ethnicity and difference in pelvic configuration^{10, 11}. No study with such large sample size currently exists particularly for the South Asian population. The aim of our study

is to compare labor pattern at 4cm and 6 cm cervical dilatation in spontaneous labor in low risk nulliparous women.

MATERIALS AND METHODOLOGY

This prospective observational study was conducted at a tertiary referral centre between January 2015 to May 2016. The study was started after approval from clinical research ethics committee of institute. Nulliparas attending labor room were screened for the study, inclusion criteria were: 37-41 weeks of gestation, singleton viable intrauterine pregnancy, and vertex presentation in the first stage of labor with cervical dilatation of [?] 4 cm with reassuring fetal heart rate. Exclusion criteria were; any contraindications for vaginal delivery, evidences of fetal malformations, intrauterine growth retardation and chronic maternal medical or surgical illness. A total of 500 nulliparas were recruited.

Informed written consent was taken from women after explaining detailed plan, purpose and duration of study. After taking a detailed history and clinical examination, participants were randomized into two groups A and B according to computer generated table.

A graphical record of cervical dilatation and descent was made on the WHO modified partograph. In group A, 250 women were marked on the alert line at 4 cm and then progress was documented. In group B, 250 women were also marked on the alert line at 4 cm and again shifted back to alert line at 6 cm (assuming commencement of active phase from 6 cm) if they the crossed alert line. Between 4 and 6cm, Group B women were considered in latent phase. They were only monitored with supportive care without any intervention provided maternal and fetal status were reassuring. Labor pattern in both groups was evaluated. Time taken for dilatation of the cervix from 4 to 6cm was noted in all women. The rate of dilatation was calculated retrospectively in all women who underwent vaginal delivery. Outcome was to study, the average labor pattern curve of all parturients, and to see the labor duration using the modified WHO partogram. The results were considered to be statistically significant when $p < 0.05$. Data analysis was performed using SPSS version.

STATISTICAL ANALYSIS

All statistical analyses were performed using SPSS version. Assuming that labour data was log normally distributed, distribution of times for progression from one integer centimetre of dilatation to the next was calculated from the median value. Women were plotted on modified WHO partograph, when they are 4 cm dilated so in both groups, the labour curve starts from 4 cm. An interval-censored regression was used and the regression was carried out in reverse, using 10 cm as the starting point and going backward. For normally distributed data, differences between groups were assessed using Student's t-test. ($P < 0.05$ for all comparisons) .

RESULTS

According to inclusion and exclusion criteria, 500 women in labor were recruited and were randomized in 2 groups A (n=250) at 4 cm and group B(n=250) at 6 cm. The baseline variables, including the mean age and mean length of gestation were comparable in both groups. As shown in table 1, the mean duration of labor in progressing from 4-6 cm cervical dilatation and then from 6-10 cm was almost similar in both groups. If total time in reaching from 4-10 cm was observed in both groups, Women in group B took more time to progress from 4 cm to 10cm, but the difference was not statistically significant ($P=0.63$). The 95th percentile value was 8.27 hours and 9 hours respectively in group A and group B.

Figure 1 depicts labour pattern curves based on median values for both the groups. Assuming that labor data were log normally distributed, distribution of times for progression from one integer centimetre of dilatation to the next was calculated from the median value. Because women were plotted on the modified WHO partograph when they are 4 cm dilated so labor curve starts from 4 cm. Both curve shows that labour accelerates after 6cm cervical dilatation in both groups.

When active phase slope was calculated linearly, the mean slope was found to be 1.1 cm/hour and 1.4

cm/hour in group A and B with no statistical difference. The minimum slope was same i.e. 0.6 cm/hour in both the groups. When comparing slope from 6-10 cm it was 1.6cm/hour and 1.4 cm/hour in groups A and B.

In Table 2, when monitoring was observed using modified WHO partograph, in group A 133 women (53.2%) and in group B, 209 women (83.6%) remained on or left of the alert line which is statistically significant ($p=0.0001$). In groups A and B 12% and 6.4% crossed the action line respectively.

DISCUSSION

Main findings

Same rule of 1cm/hour of labor progression cannot be applied to every woman and inappropriate intervention should be withheld until labor progression does not fall below 0.5cm/hour. Commencement of active phase from 4 cm vis avis 6 cm should also be redefined. The historical definition of abnormal labor and dystocia is again rethinkable in current scenario and now is a time to change these definitions. Most women had not entered in active phase at 4 cm, and they require more time for them to be called in abnormal labor. This may affect the outcome of labor, and could decrease unnecessary interventions which can affect the mother and fetus.

Strength and limitations

To the best of our knowledge, this is the first study that is done on south Asian population with such large sample size. A small study was done in India by Pitchaimuthu and Bhaskaran with 156 primigravidas and concluded that mean rate of cervical dilatation in active phase in Indian women was approximately equivalent to the lowest acceptable rate of cervical dilatation in Friedman's study¹².

There are few limitations, like women that are having caesarean section for labor dystocia have different patterns of labor curves, that we have not mentioned, because only 4% of women underwent caesarean section for protraction or arrest disorder in both groups, and this might had not affected our results. It was also a single centre study reflecting only Indian population. Due to different demographic and anthropometric measurements in different regions of south Asian population, caution is warranted before extrapolating results to different regions. Due to small sample size, further large scale, multi centred study is needed to generalise the results in whole population.

Interpretation

Most of the women were in the age group between 22 to 26 years. The mean age of our study was 24.84 ± 3.49 years in group A and 24.62 ± 3.70 in group B. Our mean age is comparable to the recent studies⁷⁻⁹, which is different from other labor studies which were done century past by Friedman et al¹⁻³. It may be explained as a result of increase in age of marriages and delayed child birth.

The median duration of active phase of labor from 4 cm was 5hours in group A and 5.21 hours in group B. Observation of different studies like Zhang et al, also shows similar median active phase duration⁶⁻⁹. Friedman reported mean duration of 4.4 hours for the active labor duration among nulliparous females. This mean duration was similar to the observation of others in 1960s¹³.

The upper limit of normal, i.e. mean+2SD is 9 hours and 6 hours respectively in progression from 4cm and 6cm to full dilatation. Similar to us, other recent studies are also reporting that low-risk nulliparous women who are delivering vaginally and undergoing spontaneous delivery without oxytocin, epidurals, and operative deliveries have duration between 6.2-7.7 hours at the mean and up to 13.4-19.4 hours at the mean + 2SD¹⁴. Friedman's upper limit of normal (mean+2SD) was 11.7 hours and his active phase began from 2.5cm cervical dilatation and his 45-53% of active phase duration was passed in the acceleration phase when only dilatation changes from 2.5cm to 4 cm¹⁻³. The mean duration in progressing from 6cm to 10 cm cervical dilatation (i.e. almost similar to phase of maximum slope according to Friedman) in our study was 2.57 ± 1.31 hours in Group A and 2.79 ± 1.72 hours in group B. The mean duration of phase of maximum slope, i.e. from 4cm to 9 cm, of Friedman study was found to be 1.67 ± 1.25 hours¹⁻³.

Coming to the labor pattern curve, our curve has only acceleration phase and phase of maximum slope. The original Friedman’s curve also had latent phase and deceleration phase. We did not plot latent phase. On comparing with Friedman curve, our curve was flatter than him and there is no rapid uprise at 4-5 cm. Our mean slope was 1.1 cm/hour and Friedman’s mean slope was 1.6cm/hour. The mean rate of dilatation in the phase of maximum slope in Friedman’s curve was twice as high i.e. 3 cm/hour. At mean- 2SD, minimum active phase dilatation rate in both groups was 0.6cm/hour, which represents slowest yet normal labor in our study. Since Friedman didn’t calculated minimum slope, if his curve was extrapolated it was 1.2 cm /hour¹⁵. This was twice as reported by our study observations and other recent studies. We have also observed that even if labor progresses at <1cm/hour, vaginal delivery can still be achieved. We have also found that slope of labor curve changes after 6cm in both groups which was observed on Friedman’s curve at 4 cm, so we can consider it as the onset of active phase. Our findings provide new data from the perspective of South Asian population. The observations reported in similar studies by Zhang⁶⁻⁸ in the US, Suzuki in Japan¹⁶, Shi in china⁹, and their colleagues, which suggest that labour progresses more slowly than previously thought. In a recent study by Oladapo et al, any interventions done to expedite labor, especially before 5 cm to conform a cervical dilatation threshold of 1 cm/hour, is inappropriate, in both nulliparous and multiparous women. Their 95thpercentile values from one level of dilatation to the next during the traditional active phase yielded median rates between 0.1 and 0.5 cm/hour between 4 and 10 cm¹⁷. We did not plot deceleration phase in majority of curves, but often in women with protraction and arrest disorder. It suggests that deceleration phase is an indicator for dystocia. Without the “deceleration phase,” the slope of the active phase in our curve is less steep than the Friedman curve. This will have a significant impact on the definitions of active phase protraction and arrest disorder.

Recently in 2018, WHO also supported by observing new evidences. Now 5 cm is cut off for both nulliparous and multiparous for commencement of active phase¹⁸. National Institute for Health and Care Excellence guidelines for intrapartum care, have also been modified to state a minimum acceptable rate of progress in active first stage is 0.5cm per hour¹⁹.

Conclusion

We conclude that 6cm rather than 4cm of cervical dilatation is more appropriate landmark for the start of the active phase. Allowing labor to continue for a longer period before 6 cm of cervical dilation may reduce the rate of unnecessary intrapartum interventions and caesarean section for labor dystocia. A woman to be considered in latent phase if cervical dilatation is less than 6 cm and other maternal and fetal conditions are reassuring, she should be allowed to continue the labor process without any intervention.

ACKNOWLEDGMENTS: I thank all the women who consented to participate in the study as well as the staff at the centre for their assistance with study enrolment. I am grateful to Professor Sunita Malik for their efforts in creation of the project and increasing the feasibility of the research. I am thankful to my mother Rekha Purwar, my husband Dr Alok Jaiswal for their supports.

DISCLOSURE OF INTEREST : The authors have no conflicts of interest in connection with this article.

CONTRIBUTION TO AUTHORSHIP: RP and SM conceived and designed the study. RP acquired the data. ZK carried out the statistical analysis. SM, AM, PP, PM and SS supervised the study. RP wrote the paper. RP and SM analysed and interpreted the data, critically revised the manuscript for important intellectual content and take responsibility for the integrity of the data and the accuracy of the data analysis.

DETAILS ETHICS APPROVAL: This project was approved by institute Ethics Committee of VMMC and SJH, New Delhi (date of approval: 25 November 2014; reference number: IEC/VMMC/SJH/Thesis/November-2014/376). All participants provided written informed consent.

FUNDING: The author received no financial support for the research, authorship, and/or publication of this article

REFERENCES

1. Friedman EA. The graphic analysis of labor. Am J Obstet gynecol 1954;68: 1568-75.
2. Friedman EA .Primigravid labor: a graphic statistical analysis. Obstet Gynecol 1955;6:567-89.
3. Friedman EA. Labor: clinical evaluation and management.2nd ed. New York (NY): Appleton-Century-Crofts; 1978.
4. Betran AP, Ye J, Moller AB, Zhang J, Gulmezoglu AM, Torloni MR. The Increasing Trend in Caesarean Section Rates: Global, Regional and National Estimates: 1990±2014. PLoS ONE. 2016; 11(2):e0148343.
5. American College of Obstetricians and Gynecologists, Society for Maternal-Fetal Medicine, Caughey AB, Cahill AG, Guise JM, et al. Safe prevention of the primary cesarean delivery. Am J Obstet Gynecol. 2014; 210(3):179±93
6. Zhang J, Troendle JF, Yancey MK. Reassessing the labor curve in nulliparous women. Am J Obstet Gynecol. 2002; 187(4):824±8.
7. Zhang J, Troendle J, Mikolajczyk R, Sundaram R, Beaver J, Fraser W. The natural history of the normal first stage of labor. Obstet Gynecol. 2010; 115(4):705±10
8. Zhang J, Landy HJ, Branch DW, Burkman R, Haberman S, Gregory KD, et al. Contemporary patterns of spontaneous labor with normal neonatal outcomes. Obstet Gynecol. 2010; 116(6):1281±7. \
9. Shi Q, Tan XQ, Liu XR, Tian XB, Qi HB. Labour patterns in Chinese women in Chongqing. BJOG. 2016;123 Suppl 3:57±63.
10. Cohen WR, Friedman EA. Perils of the new labor management guidelines. Am J Obstet Gynecol. 2015; 212(4):420±7.
11. Cohen WR, Friedman EA. Misguided guidelines for managing labor. Am J Obstet Gynecol. 2015; 212(6):753.e1±3.
12. Pitchaimuthu N, Bhaskaran S. Labor pattern among primigravida in local population. J Obstet Gynaecol India 2018;68:482–6.
13. Hendricks CH, Brenner WE, Kraus G. Normal cervical dilation pattern in late pregnancy and labor. Am J Obstet Gynecol1970;106: 1065-80.
14. Jones M, Larson E. Length of normal labor in women of Hispanic origin. Journal of Midwifery & Women’s Health. 2003; 48(1):2–9.
15. Friedman EA, Kroll BH. Computer analysis of labor progression. III. Pattern variations by parity. Journal of Reproductive Medicine. 1971; 6(4):179–183.
16. Suzuki R, Horiuchi S, Ohtsu H. Evaluation of the labor curve in nulliparous Japanese women. Am J Obstet Gynecol. 2010; 203(3):226.
17. Oladapo OT, Souza JP, Fawole B, Mugerwa K, Perdonâ G, Alves D, et al. (2018)Progression of the first stage of spontaneous labour: A prospective cohort study in two sub-Saharan African countries. PLoS Med 15(1).
18. WHO Reproductive Health Library. WHO recommendation on definitions of the latent and active first stages of labour. (February 2018). The WHO Reproductive Health Library; Geneva: World Health Organization.
19. National Institute for Health and Care Excellence. Intrapartum care: care of healthy women and their babies during childbirth. 2014(Clinical guideline 109).

Table 1: Duration of labour with respect to cervical dilatation at different phases of first stage

Cervical dilatation	Group A	Group A	Group B	Group B	p va
	Mean(hours)	Median(hours) (95 th percentile)	Mean(hours)	Median(hours) (95 th percentile)	
4-6cm	2.67±1.32	2(5.0)	2.69±1.41	2.0(6)	p=0
6-10cm	2.54±1.31	2(5.0)	2.79±1.72	2.5(6)	p=0
4-10cm	5.12±2.01	5(8.27)	5.21±2.16	5.21(9)	p=0

Table 2: Evaluation of progress in first stage of labour using modified WHO partograph

	<i>Group A</i> N=250 (%)	<i>Group B</i> N=250 (%)	<i>p value</i>
Normal Active Phase	133(53.2)	209(83.6)	p=0.0001
Moved between Alert and Action	87(34.8)	25(10)	p=0.0001
Reached or Crossed Action Line	30(12)	16(6.4)	p=0.06

Hosted file

FIGURE FILE.docx available at <https://authorea.com/users/313282/articles/443824-progression-of-first-stage-of-labor-in-low-risk-nulliparas-in-south-asian-population-a-prospective-observational-study>