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Analysis of demographic characteristics affecting labour curve in low risk pregnant woman in tertiary care hospital in Central India

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Abstract---Background: Since decades labour curve given by E. Friedman in 1950 is used in obstetrics practices all over the world; but recent studies have highlighted labour progression pattern which deviates from Friedman's curve. Recently there have been many studies done to focus on progress of labour in contemporary labouring females. Till date no other study has been focused on developing labour curves for Indian origin females. This study is done to evaluate pattern of labour progress in central Indian origin female. Objective: To analyse demographic characteristics affecting spontaneous labour progression in low risk pregnant females of central Indian origin. Material and methods: It was prospective observational study done from August 2017 to July 2018. Low risk term pregnant women with spontaneous onset of labour were included and findings were entered in a pre-structured format. Results: Mean age of study population was 24.43 years with a range of 18 to 35 years. Mean body mass index (BMI) of study population was 21.49 with a range of 18.5 - 30 kg/m². Maximum number of females were nulliparous i.e 79.10%. Mean cervical dilatation at admission was 4 cm. Mean duration of active phase of labour was 3.66 hrs. Mean duration of second stage of labour was 38.4 minutes. Mean rate of cervical dilation in active phase of labour was 1.42 cm/hour. Conclusion: Demographic features of our study population are different from other studies done in various parts of world. Labour curve of our study population is also different from contemporary labour curves. Labour curve of our study population is comparable with classic Friedman's curve in terms of extent of labour duration and duration of second stage of labour, but it differs from it in start of active phase of labour, rate of cervical

dilatation. But whether this curve should be accepted as for Indian population, still need validation by some more studies.

Keywords---analysis demographic, characteristics affecting, labour curve, low risk pregnant woman.

Introduction

Last few decades had seen an increase in rate of caesarean delivery but without any decrease in maternal and neonatal morbidity or mortality rate^{1,2}. One of most sited reason of caesarean delivery is abnormalities of labour progress followed by foetal heart rate abnormalities³. Apart from the fact that caesarean delivery is detrimental to mother and newborn both, it has various other complications viz. morbidly adherent placenta, scar dehiscence, neonatal respiratory distress and sepsis etc, which is of main concern.²⁻⁶ Considering the ill effects of caesarean deliveries, much focus has been shifted on reduction of incidence of primary caesarean itself. In order to prevent primary caesarean deliveries it is essential to critically analyze the criteria which are used to label a labour as abnormal labour. Our understanding of labour curves mainly depend on Friedman's labour curve which was given decades ago from now and may not be applicable to current parturient women who are different from that of population studied by Friedman decades ago. Moreover, Friedman's labour curves were derived from a small number of women which was only American group while recent studies, done across the globe, emphasize upon direct relationship of demographic and clinical characteristics like maternal weight ,height ,BMI, parity ,gestational age and neonatal weight with labour progression. In 2010 Zhang et al⁷ published his study, done on large number of American parturient women and came up with new labour curves, based on which American college of Obstetricians and Gynecologists (ACOG) and Society for Maternal – Fetal Medicine (SMFM) released new set of recommendations to identify abnormality of labour progress.⁷ Since the time, Zhang et al⁷ published their labour curves, a fair exchange of concerns are expressed over adopting these curves as standard practice world wide.As labour is a complex physiological process being effected by various factors based on demographic features of study population .Moreover, the results derived from this study actually affect our understanding of labour progression which effects the maternal and foetal outcomes . Till date no previous study has focused on labour patterns in Indian females with a large sample size. The purpose of current study was to analyze labour curves of Indian origin females and to discuss relationship of various factors influencing labour progression.

Objectives

The primary objectives were:

1. To compute for the mean cervical dilatation at admission, duration of labour from 4cm dilatation to full cervical dilatation and duration of full cervical dilatation to delivery.

2. To construct the curve for cervical dilatation against time.

The secondary objectives were:

1. To determine the demographic characteristics of the study population as to:
 - a. Age, BMI, parity
 - b. Gestational age at delivery
2. To determine the profile of the newborns of the mother in the study population according to birth weight.
3. To determine association of cervical dilatation rate with BMI, parity, Gestational age, neonatal weight and extent of effacement.

Materials and Methods

This was a prospective observational study conducted from August 2017 to July 2018. The study was conducted at Department of Obstetrics and Gynaecology, SS Medical College Rewa. Approval was given by Institutional Ethics Committee. All patients admitted in the labour room during the course of study and fulfilling the inclusion and exclusion criteria were taken in the study. After considering inclusion and exclusion criteria all laboring females were allowed to progress naturally and a four hourly labour progression was recorded. All females who required augmentation, caesarean or instrumental delivery were excluded from the study. On the basis of individual labour progress curve which were obtained, a final composite labour curve was drawn and appropriate statistical tests were applied to calculate mean duration and rate of progression of labour. Demographic characteristics and their association with labour progression was also studied.

Inclusion criteria

1. Term pregnant female of Indian origin
2. Maternal age: 18-35 years old
3. Gestational age: 37 weeks to 41 weeks
4. Spontaneous onset of labour
5. First to fourth gravida with singleton pregnancy with vertex presentation
6. Cervical dilatation less than or equal to 4cm
7. Normal neonatal outcome

Exclusion criteria

1. Induced labour, Elective LSCS or emergency LSCS
2. With history of any medical illness
3. High risk pregnancy
4. Oxytocin augmented labour

Figure 1 depicts the process of selection of final study population

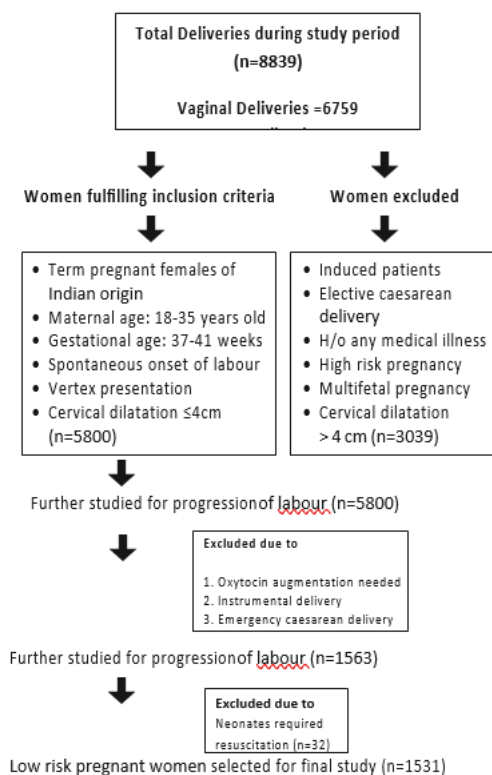


Figure 1. Selection of final study population

Results

A total of 1531 low risk pregnancy cases (n=1531) were included in the study. Table 1 shows demographic characteristics of study population. Mean age of study population was 24.43 years with a range of 18 to 35 years. Mean BMI of study population was 21.49 with a range of 18.5 - 30 kg/m². Maximum number of females were nulliparous i.e 79.10%. Mean gestational age was found to be 39.05 weeks with a range of 37 to 41 weeks. Mean neonatal weight of study population was 2.39 kg with a range of 1.5 to 3.5kg.

Table 1. Demographic characteristics of study population

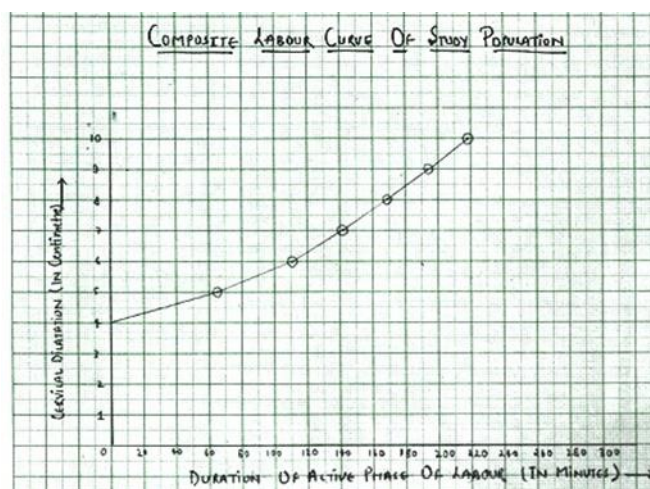
Variables	Mean	Range
Age (years)	24.43	18-35
BMI (kg/m ²)	21.49	18.5-30
Gestational age (weeks)	39.05	37-41
Neonatal weight (kg)	2.39	1.5-3.5

Table 2 and figure 2 show findings derived from composite labour curve of study population. It shows that although labour progress may be low from 4-5 cm in comparison with 6 cm onward but progression from 5-6 cm is not very slow and is not statistically different from 6 cm onward dilatation.

Table 2. Composite labour curve of study population

S.no	Cervical dilatation (cm)	Mean duration of progress (minutes)
1	4-5	65.34
2	5-6	45.36
3	6-7	32.28
4	7-8	26.22
5	8-9	25.14
6	9-10	24.96

Figure 2. Composite labour curve of study population



Mean cervical dilatation at admission was 4 cm. Mean duration of active phase of labour was 3.66 hours. Mean duration of second stage of labour was 38.4 minutes. Mean rate of cervical dilatation in active phase of labour was 1.42cm/hour (Table 3).

Table 3. Clinical Characteristics

S. No.	Clinical characteristics	Duration
1.	Mean Cervical dilatation at admission	4cm.
2.	Mean total duration of active phase of labour	219.3min (3.66hr)
3.	Mean duration of second stage of labour	38.4min (0.64hr)
4.	Mean cervical dilatation rate during active phase of	1.42cm/hr (± 0.41)

	labour	
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We have found that BMI is directly related to rate of cervical dilatation. Mean rate of cervical dilatation was 1.46 cm/hr in group with BMI <18.5. The rate of cervical dilatation was less in the group with BMI >30 i.e. 0.9 cm/hr (*Table 4*).

Table 4. Association of BMI with rate of cervical dilatation in cm/hour

BMI	N	Mean	Standard deviation	P value
Underweight (< 18.5)	434	1.46	0.34	0.00
Normal (18.5 to 24.9)	1027	1.40	0.44	
Overweight (>24.9 to 29.9)	61	1.38	0.25	
Obese (>30)	9	0.9	0.11	
Total	1531	1.42	0.41	

Parity was also directly associated with rate of cervical dilatation. Rate of cervical dilatation was 1.38 cm/hr with parity-0 and parity-1, which increases to 1.73 cm/hr with parity >1 (*Table 5*).

Table 5. Association of parity with rate of cervical dilatation

Parity	N	Mean	Standard deviation	P value
P0 to P1	1386	1.388	0.403	0.00
More than P1	145	1.734	0.359	
Total	1531	1.421	0.412	

It was found that gestational age was inversely associated with rate of cervical dilatation. Rate of cervical dilatation was 1.69 cm/hr with gestational age range from 37-39 week, which decreases to 1.38 cm/hr with gestational age range from 39 week 1 day – 41 week (*Table 6*).

Table 6. Association of gestational age with rate of cervical dilatation

Gestational age	N	Mean	Standard deviation	P value
37 to 39 week	1386	1.697	0.403	0.00
39 week 1 day to 41 week	145	1.388	0.409	
Total	1531	1.417	0.413902	

Neonatal weight was inversely related with rate of cervical dilatation. With birth weight range 1.5-2.5 kg, rate of cervical dilatation was 1.43 cm/hr, which

decreased to 1.38 cm/hr with birth weight range 2.6 - 3.5 kg; which is statistically significant (*Table 7*).

Table 7. Association of neonatal weight with rate of cervical dilatation

Neonatal weight	N	Mean	Standard deviation	P value
1.5 to 2.5 kg	1007	1.436	0.431	0.013
2.6 to 3.5 Kg	524	1.381	0.376	
Total	1531	1.417	0.413	

Discussion

For decades labour management was based on sigmoid shaped labour curve given by Friedman years ago while contemporary labour guidelines are basically based on work of Zhang et al⁷. None of these studies are done on Indian females. In the present study we have tried to derive a labour curve for central Indian population and to analyse the association of various demographic characteristics on labour progression. In present study mean duration of active phase of first stage of labour is 3.66 hr. Duration of active phase of labour as per Friedman's study is 2.5 hr. As per Zhang et al⁷ mean duration of active phase is 5.5 hr. As per recent Japanese study by Suzuki et al⁸ mean duration of active phase is 5 hr. A study done by Lugie B et al⁹ in Filipino women also found mean duration of active phase as 5 hr. This clearly signifies that duration of active phase of labour for our study population differs from all studies done on women with varying demographic characteristics in different areas of world. Mean rate of cervical dilatation in active phase of labour is 1.42 cm/hr. As per Friedman's rate of cervical dilatation i.e 3cm/hr. As per Zhang et al⁷ labour progress differentially at different degree of dilatation. In present study mean duration of second stage of labour is 0.64 hr (38.4 min). This duration is found comparable with study done by Jones et al¹⁰ who found it 54 min. and with Albers et al¹¹ who found it 53 min. in this aspect our results are also comparable with Friedman. But as per Zhang et al⁸ mean duration of second stage is 2.8 hr. Q Shi et al¹² who studied Chinese population found duration of second stage 1.93 hrs. In present study at 6 cm dilatation there is rapid change in rate of cervical dilatation. Cervical dilatation of our study population at onset of active labour is comparable that with Zhang's study. As per Zhang et al⁷ there is a change in cervical dilatation rate at 6cm cervical dilatation. Q Shi et al¹² studied Chinese population and found 6 cm cervical dilatation at onset of active phase, but onset of active phase was bit delayed in study done by Suzuki et al in Japanese population. As per Suzuki et al⁸ 6-7 cm cervical dilatation is marked as onset of active phase. But these contemporary studies and our own study differ from Friedman's study as per him onset of active phase of labour occurs at 4 cm cervical dilatation.

These differences in labour characteristics may be due to different demographic characteristics of different study population. Greenberg et al¹³ also found that black women had shorter duration of second stage of labour and concluded that ethnicity effects progression of labour. Jones M et al¹⁰ also found that in

Hispanic women length of active phase of first stage of labour is longer than that of Friedman's group that concluded that this variation is due to difference in race and ethnicity of study population. Diegmann et al¹⁴ also found that African American women have shorter duration of second stage of labour than that of Puerto Rican women and concluded that labour progresses differently in different ethnic groups. BMI of study population also affects labour progression. Majority of our study population have BMI <24.9. Anjel Vahratianh¹⁵ also concluded in his study that labour progression in over weight and obese women was significantly slower than that of normal weight women before 6 cm of cervical dilatation. Oladapo O T et al¹⁶ also found that time difference to reach 10 cm dilatation was 1.2 hour from lowest BMI (<25) to highest BMI (>40) for nulliparous women. He also concluded that labour proceeds more slowly as BMI increases, suggesting that labour management be altered to allow longer time for these differences.

Conclusion

Definition of normal labour and its deviation to abnormal is basically based on work done by Dr. Emanuel Friedman in midst of 1950 and beyond. Due to change in obstetric practice and demographic characteristics of present day population Friedman's study is reviewed in contemporary population by various researchers. All major recent studies done have basically considered cervical dilatation as a marker for progression of labour. But we all know that labour is a complex process with several factors effecting its progression like parity, gestational age, strength of contractile force, status of membrane, BMI of mother, weight of neonate, race and ethnicity. In the present study we have tried to consider as many of them as possible. Also most of the studies are done retrospectively and that too on foreign study population. None of them was conducted on Indian population. We have done this present study on Indian population considering several factors that may affect labour. Present study is done prospectively in a single institute for duration of one year to assess labour progression in our population and its deviation from Friedman's labour curve and other contemporary studies can be due to differences in demographic characteristics of Indian population. We need some more multicentric studies in support of our findings for validation of outcomes of this study.

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