



Labour patterns in Chinese women in Chongqing

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Objective To obtain data on the characteristics of labour from a regional sample of Chinese parturients and to assess the pattern of progress of labour among nulliparous women.

Design A prospective observational study.

Setting The study was conducted in the First Affiliated Hospital of Chongqing Medical University.

Population The final sample involved 1200 Chinese parturients with singleton, vertex and term gestation; spontaneous onset of labour; vaginal delivery; and without adverse perinatal outcomes.

Methods A repeated-measures analysis was used to depict labour curves while an interval-censored regression was used to estimate the duration of labour centimetre by centimetre.

Main outcome measures Labour curves and the duration of labour at the 50th and 95th percentiles.

Results Among 1091 nulliparous women, 57.7% had cervical dilation of 3 cm or less at the time of admission, and the mean duration of the first stage of labour was 9.1 ± 3.3 hours. From 5 to 9 cm of cervical dilation it sometimes took more than 2 hours for dilation to advance 1 cm. No obvious inflection points appeared in the labour curve of Chinese nulliparae, and no deceleration was observed.

Conclusion Progress of labour in Chinese parturients was more gradual than in their Western counterparts. Obstetric practice standards based on data generated from Western countries may not be appropriate for Chinese women.

Keywords Chinese parturient, duration of labour, intrapartum care, labour curve, nulliparous women, vaginal delivery.

Tweetable abstract A prospective study has evaluated labour patterns in Chinese women using regional data from nulliparae.

中文摘要

目的: 本研究旨在对中国重庆地区女性的分娩特点进行总结及数据采集,并进一步评估这一区域的初产妇分娩模式。

设计: 前瞻性观察性研究

研究环境 重庆医科大学第一附属医院

研究对象: 足月、单胎、头位、自然临产且经阴道分娩,不合并不良母儿结局的共1200例分娩被纳入研究。

方法: 应用重复测量分析绘制平均分娩曲线;应用区间截尾回归评估宫颈每扩张1 cm所用的时限情况。

主要测量指标: 产程曲线及产程时限的第50百分位数及第95百分位数。

结果: 在1091例初产妇中,在宫口扩张 ≤ 3 cm即入院待产者占57.7%,第一产程的平均时限为 9.1 ± 3.3 小时。在宫口扩张5–9 cm这个阶段,宫口每扩张1 cm均可能需要耗时2小时及以上的时限。本研究分娩曲线呈现的产程进展趋势中,没有发现存在明显的加速拐点,也没有发现减速期。

结论: 相对西方女性的产程情况,中国女性的产程进展更为缓慢。应用基于西方国家的产程研究数据而建立的产程管理实践对中国女性的产程进行管理可能并不适宜。

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Introduction

Obstetricians have been using the classic labour curve created by Friedman during the 1950s¹ to describe the progress of labour and guide intrapartum management for over half a century. However, during the past decade the

appropriateness of the labour curve for these purposes has been called into question by a number of researchers, including Zhang et al.,^{2–4} who argue that current patterns of labour should be reassessed. A study of Japanese women using a design similar to Zhang's indicated that the labour curve of Japanese women is smoother and more gradually

sloped than Friedman's curve.⁵ Moreover, some methodological shortcomings in the classic labour curve have also been highlighted.⁴ Subsequently, improved study designs and statistical approaches have revealed that labour patterns vary significantly across different ethnic populations and times.^{6,7}

China has witnessed marked changes in its obstetric population, such as delay in childbearing and increasing fetal size.⁸ However, the criteria available to guide intrapartum care still rely on research published 30–50 years ago.^{9,10} In the light of recent findings, the classic labour curve may no longer be suitable to act as the guiding principle for present-day obstetric practices in China. More importantly, the existing criteria for evaluating interventions during labour might increase the likelihood of caesarean section (CS), a serious public health concern in China. Given this changed context, studies addressing issues related to management of labour and delivery among Chinese women are urgently needed. We obtained data on the characteristics of labour, including the duration of labour in nulliparous women, from a population of pregnant women residing in southwest China. The aim of our study was to generate evidence to re-evaluate labour patterns among Chinese women.

Methods

This was an observational study. The data were prospectively collected between 1 September 2013 and 31 August 2014 from women at the First Affiliated Hospital of Chongqing Medical University (CQMU), a university-based tertiary care centre with 2000 beds. This project was approved by the institutional research ethics committee of CQMU.

Participants

We selected Chinese women with a singleton pregnancy with a gestational age between 37 weeks 0 days and 41 weeks 6 days, vertex presentation at admission and spontaneous onset of labour. Women were excluded if there was evidence of obesity [body mass index (BMI) ≥ 30 kg/m²] before pregnancy, use of analgesia in labour, trial of labour after previous CS or other medical conditions such as hypertension, heart disease, intrahepatic cholestasis of pregnancy or diabetes mellitus requiring control by medication. Participants with any adverse perinatal outcomes, such as fetal distress, Apgar score ≤ 7 at 5 minutes, resuscitation and/or admission to the neonatal intensive care unit, birth injury, stillbirth, infant death, postpartum haemorrhage, puerperal infection, serious laceration of the soft birth channel or maternal death during the 6-week follow up, were also excluded from the analysis. Finally, we excluded women who underwent CS during

trial of labour (2.8%) or had full cervical dilation at the time of admission.

We included women who had gestational diabetes mellitus (GDM) if their condition was controlled by dietary restrictions only. We investigated whether there were any differences in labour progression between the subgroup with GDM controlled by diet and those without GDM. No significant differences in labour progression were found between these two subgroups (Table S1) and we therefore decided to include these women in our analysis.

During the study period, 5565 deliveries took place in the study hospital, among which 3281 were performed by elective CS prior to entry into labour. A total of 1200 pregnant women were included in the analysis, comprising 1091 nulliparous and 109 multiparous women. A detailed description of the procedure for selecting the study population is provided in Figure 1.

Variables

The main outcome was the progression of cervical dilation during labour. It was recorded as '0' (the start point) at the time of admission. The time between each cervical examination and the 'start point' was collected. Other variables of interest included detailed demographic characteristics of the women, antenatal care records, labour and delivery summary, and information on the postpartum and newborn.

Data sources

Clinical data were collected by midwives who had been trained with the LaborPro system (Trig Medical Ltd, Yokneam, Israel). This training helped to minimise the subjectivity of digital examinations.¹¹ The obstetric practices employed by the team of midwives at CQMU were designed to reduce the number of interventions and to increase ambulation (walking). Measurements of cervical dilation and the station of fetal presentation were performed during pauses between uterine contractions, and during the following events: admission, membrane rupture, intensive contractions, feeling the need to push or re-evaluation after augmentation. Eligible subjects who went into labour (defined by at least two or more spontaneous contractions per 10 minutes within the last hour or longer with cervical changes or spontaneous rupture of membranes regardless of cervical dilation) were admitted to the labour and delivery unit, after which they were attended by trained midwives as per the CQMU labour management protocol (Figure S1).

GDM was diagnosed according to the new Chinese guidelines.¹² The diagnosis of premature rupture of membranes (PROM) was based on the patient's reported history and examination with a sterile speculum. It was confirmed by testing vaginal fluid with insulin-like growth factor

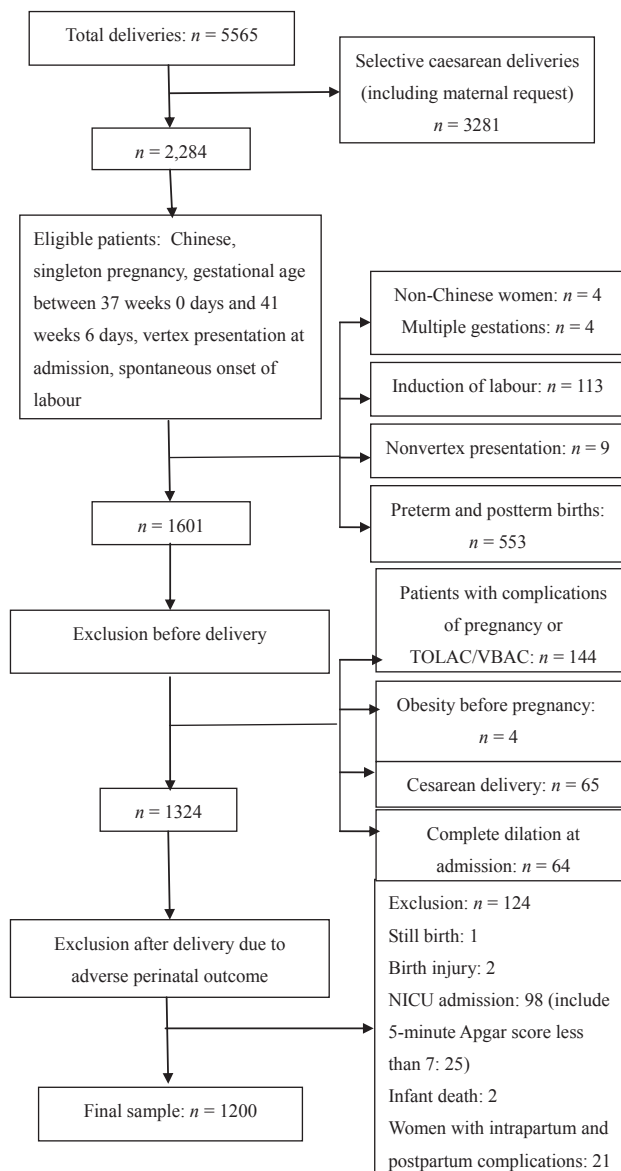


Figure 1. Protocol of data extraction. TOLAC, trial of labour after CS; VBAC, vaginal birth after CS; NICU, neonatal intensive care unit.

binding protein-1 predictor kits or by determining the amniotic fluid index with ultrasonography at regular intervals. Antibiotic prophylaxis was considered only if the duration of rupture lasted longer than 12 hours.

Statistical analysis

All statistical analyses were performed using SAS 8.2 (SAS Institute, Cary, NC, USA). We followed the same approach undertaken by Zhang et al.² In brief, an interval-censored regression was used to estimate the distribution of duration of labour for every unit (in integer centimetres) increase in cervical dilation during the entire process of labour. Patients were admitted at various degrees of cervical

dilation but all ended at 10 cm. Therefore, the regression was carried out in reverse, using 10 cm as the starting point and going backward. A repeated-measures analysis with an eighth-degree polynomial model turned out to be the best fit for the duration and dilation variables. For normally distributed data, differences between groups were assessed using Student's *t*-test. For data without a normal distribution, Wilcoxon's rank sum test was employed ($P < 0.05$ for all comparisons).

Results

Some baseline characteristics of relevant study parameters^{2,5,13,14} are described in Table 1. In the current study, 24.5% of nulliparous women resided in rural areas, in contrast to 44.0% of multiparous women. The median duration from onset of labour to admission was 4.0 hours (10th and 90th percentiles 1.3 and 8.0, respectively) for nulliparae and 3.0 hours (0.5, 5.83) for multiparae. PROM occurred in 248 (22.7%) nulliparae and 16 (14.7%) multiparae, and 57.7% of nulliparae and 59.6% of multiparae were admitted at cervical dilations of 3 cm or less. The mean duration of the first stage of labour was substantially longer in nulliparae than in multiparae [9.1 hours (SD 3.3) versus 5.6 hours (SD 2.7)]. The rate of oxytocin augmentation was 9.2% for nulliparae and 2.8% for multiparae. About half the participants (49.8% of nulliparae, 58.7% of multiparae) underwent amniotomy to facilitate labour. The rate of instrumental delivery was very low (1.3% in nulliparae). The Apgar score was above 7 at 5 minutes for all newborns, and the pH of umbilical cord venous blood ranged from 7.21 to 7.43.

Figure 2 shows the average labour curve for nulliparous women presenting with cervical dilation of 1, 2 and 3 cm at admission. The labour curves of women with 1 cm cervical dilation at admission and those with 2 cm dilation had similar trajectories. The slopes of the labour curve for these two groups became steeper after reaching 5–6 cm dilation. Among women presenting with 3 cm cervical dilation at admission, labour appeared to accelerate after achieving 4 cm dilation, as indicated by the steep inclination after that point. None of these curves showed a decelerating trend.

Table 2 presents the duration of labour by cervical dilation among nulliparous women and compares findings by Zhang et al.² and Suzuki et al.⁵ Labour appears to progress fastest in American women but slowest in Japanese women. The rate of change in cervical dilation prior to reaching 6 cm in the current study was similar to that reported by Zhang et al.² The fastest progression across all the above studies occurs between 5 and 6 cm cervical dilation. The 95th percentile of the distribution of labour durations indicates that between 5 and 9 cm of cervical dilation, it

Table 1. Characteristics of relevant studies (current, Friedman,¹ Zhang et al.,² and Suzuki et al.,⁵ studies)

Parameter	Current study		Friedman study		Zhang study		Suzuki study	
	Nulliparae	Multiparae	Nulliparae	Multiparae	Nulliparae	Multiparae*	Nulliparae	Multiparae
Candidate collection	1091 Chinese Rural 24.5% Urban 75.5%	109 Chinese Rural 44.0% Urban 56.0%	500 American	500 American	27 170 White 60% African American 12% Hispanic 20% Asian 4% Others 4%	35 245 White 53% African American 13.5% Hispanic 27.5% Asian 3% Others 3%	2369 Japanese	
Data collection method	Direct assessment	Direct assessment	Direct assessment	Direct assessment	Secondary analysis of medical records	Secondary analysis of medical records	Secondary analysis of medical records	Secondary analysis of medical records
Years of data collection	2013–14		Early 1950s	Early 1950s	2002–08		2001–05	
Maternal age (years)	27.0 ± 3.2	31.5 ± 5.2	NA (range 13–42)	NA (range 17–43)	24.6 ± 5.8	27.7 ± 5.7/30.0 ± 5.4*	28.4 ± 4.5	
Gestational age at delivery (weeks)	39.5 ± 0.9	39.4 ± 1.1	Term	Term	39.3 ± 1.2	39.2 ± 1.2/39.1 ± 1.1*	Term	
BMI before pregnancy (kg/m ²)	20.0 ± 2.2	20.8 ± 2.3	NA	NA	23.4 ± 4.6	24.2 ± 5.1/25.5 ± 5.6*	20.2 ± 2.4	
BMI at delivery (kg/m ²)	26.1 ± 2.8	26.5 ± 2.6	NA	NA	29.1 ± 5.0	29.6 ± 5.2/30.5 ± 5.5*	NA	
GDM controlled by diet, n (%)	201 (18.4)	15 (13.8)	NA	NA	NA	NA	NA	
PROM, n (%)	248 (22.7)	16 (14.7)	NA	NA	NA	NA	NA	
Pelvic examination frequency (VE and RE)	Irregular by events (VE)		Regular (RE), VE by events		Irregular by events (VE)		Irregular by events (VE)	
No. of pelvic examinations	4 (3, 6)	3 (2, 5)	NA	NA*	5 (1, 9)	4 (1, 7)/4 (1, 7)*	5 (range 2–16)	
Oxytocin augmentation (%)	9.2	2.8	9.4	11.2	47	45/45*	6.5	
Amniotomy for augmentation (%)	49.8	58.7	Na ^a	NA	NA	NA*	NA	
Instrumental delivery (%)	1.3	0	56.8	22	12	3/2*	3.5	
Birthweight (g)	3300.8 ± 330.0	3362.5 ± 352.0	NA* (range 2080–4710)	NA* (range 1890–4770)	3296.0 ± 406.0	3384.0 ± 421.0/3410.0 ± 428.0*	3036.0 ± 311.6	

NA, not available; RE, rectal examination; VE, vaginal examination.

Data are per cent, mean ± standard deviation or median (10th, 90th percentile) unless otherwise specified.

*The multiparous group in the Zhang et al. study was divided into two groups: Parity 1 and Parity 2⁺.

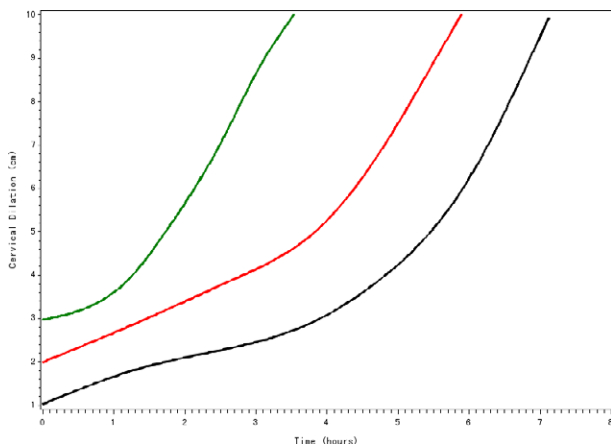


Figure 2. Average labour curves by 1, 2 and 3 cm cervical dilation at admission in singleton term pregnancies with spontaneous onset of labour, vaginal delivery and normal maternal–neonatal outcomes.

Table 2. Comparisons of duration of labour (of spontaneous onset) in hours for nulliparous women

Cervical dilation (cm)	Current study	Zhang et al. ² study	Suzuki et al. ⁵ study
2–3	2.67 (7.2)	NA	7.5 (21.0)
3–4	2.00 (4.2)	1.8 (8.1)	6.2 (17.7)
4–5	1.71 (4.0)	1.3 (6.4)	4.8 (15.7)
5–6	1.00 (2.5)	0.8 (3.2)	3.3 (10.7)
6–7	1.00 (2.3)	0.6 (2.2)	2.6 (9.3)
7–8	0.92 (2.1)	0.5 (1.6)	1.8 (6.8)
8–9	1.00 (2.5)	0.5 (1.4)	1.0 (4.4)
9–10	0.33 (1.0)	0.5 (1.8)	0.9 (2.6)
Second stage	0.83 (1.93)	0.6 (2.8)	NA

NA, not available.

Data are hours, median (95th percentile) unless otherwise specified.

sometimes took more than 2 hours for dilation to advance by 1 cm in our study. The median duration of labour without epidural analgesia during the second stage in Chinese nulliparae was longer than that in American women. However, the 95th percentile was 1.93 hours in the current study, shorter than that observed in Zhang et al.'s study (2.8 hours).²

Discussion

Main findings

Labour appears to progress more slowly in Chinese nulliparous women than in American women. From 5 to 9 cm of cervical dilation, it sometimes took more than 2 hours for dilation to advance 1 cm. No obvious inflection points appeared in the labour curve of Chinese nulliparae, and no deceleration was observed.

Strengths and limitations

To the best of our knowledge, this study was the first attempt in China to employ novel research approaches to quantify the duration of labour in Chinese women. However, several limitations are worth mentioning.

Similar to previous reports,^{15,16} a large proportion of women in the current study (58.9%) chose to deliver their baby via elective CS. Although the factors contributing to this preference as well as their impact on progression of labour remain unclear,¹⁷ we anticipated, based on our clinical experience, that women likely to experience slow progress of labour might be more likely to make this choice. This would lead to an underestimation of the duration of progress of labour. Moreover, as a single-centre study, the results of our study only reflect the conditions of labour and delivery among Chinese parturients living in southwest China. Given the heterogeneity of demographic characteristics and their potential impact on progress of labour, caution is warranted when extrapolating the results of the present study to other regions.

Additionally, although we introduced the LaborPro system to train the team of intrapartum care providers in order to minimise subjectivity in measurements, bias is difficult to eliminate and it is challenging to quantify its influence on results. Finally, the accuracy of our estimations in some subgroups was hampered by the small sample size and irregular examination intervals. This might explain the discrepancy between the duration of labour indicated by the average labour curve (Figure 2) and that estimated by the interval-censored regression model (Table 2). A multi-centre study with a larger sample size is needed.

Interpretation

The speed of cervical dilation is a crucial measure of labour progression. We found that the 95th percentile time for dilation to advance by 1 cm between 5 and 9 cm was more than 2 hours. After 5 cm, the speed doubled but still remained gradual (the median time was approximately 1 hour and the 95th percentile time was more than 2 hours). This rate differs from that noted in the studies by Zhang et al.² and Suzuki et al.⁵ The 95th percentile duration of the second stage, 1.93 hours, was less than the duration reported for American nulliparae (2.8 hours), which constitutes the basis for the new standard duration for the second stage of labour recommended by the American Congress of Obstetricians and Gynecologists.¹⁸ However, the median duration in this study was slightly longer than that obtained by Zhang et al.² A possible explanation could be that care providers might be subconsciously limiting the second stage to 2 hours on the basis of existing guidelines.

In the Friedman curve, an obvious inflection point occurs between 3 and 4 cm of cervical dilation. The curve has a rapid acceleration after the inflection point, followed

by deceleration. Our study did not confirm this pattern. Instead, our curve is similar to those of Zhang et al.² and Suzuki et al.⁵ There is no clear inflection point in the nulliparous curve and the relatively rapid change occurs between 5 and 6 cm. No deceleration was observed at the end of the first stage.

Finally, some important differences in maternal and fetal characteristics were also noted between previous relevant studies and the current one. The BMI before pregnancy was similar in Chinese and Japanese women but lower than that of American women. Recent studies have reported that labour proceeds more slowly as BMI increases.¹⁹ However, we found that the American women had the fastest progression of labour, whereas the Japanese women had the slowest. Several factors, such as maternal age, newborn weight and different management strategies, may explain these differences. Chinese babies had a similar birthweight to American newborns but were heavier than their Japanese counterparts. Oxytocin augmentation is rather common in the USA but labour interventions are rarely employed in Japan.^{2,5} In China, healthcare providers routinely perform amniotomies to augment labour. The differences in management may also explain the differences in labour pattern to some degree.

Conclusion

In summary, we found that labour in Chinese women appears to proceed more slowly than previously assumed. Thus, it may not be appropriate to apply previous obstetric practice standards based on labour parameters obtained from Western women to intrapartum management of Chinese women. We hope that our findings can promote better understanding of contemporary progress of labour in Chinese women and improve intrapartum management practices.

Disclosure of interest

The authors declare that they have not received grants, speakers fees, etc., from any commercial body within the past 2 years, and have no potential conflicts. Completed disclosure of interests form available to view online as supporting information.

Contribution to authorship

QS and HBQ designed the study. QS and XQT collected and analysed the data. HBQ and QS interpreted the data and outcomes. QS and XRL wrote the paper. All authors critically reviewed the manuscript and approved the final version before submission.

Details of ethics approval

This work is one of multiple studies of labour progress in Chinese women conducted by CQMU. Thus, the ethical

approval for the study was given by the committees of CQMU. Date of approval: 26 April 2012.

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Supporting Information

Additional Supporting Information may be found in the online version of this article:

Figure S1. Labour management protocol in use at CQMU.

Table S1. Comparison between populations with and without GDM. ■

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