Analysis of Risk Factors and Maternal-Neonatal Outcomes in Women with Prolonged Labor >24 Hours: Postprint

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Date: 2023-07-25T00:00:00+00:00

Abstract

Background: Standardized labor management is crucial for ensuring maternal and infant safety. With the release of the new labor model, the concept of prolonged labor is no longer emphasized. Under the new labor model, interventions during labor should be minimized, consequently increasing the number of parturients with total labor duration >24 hours. Objective: To analyze the risk factors and maternal-neonatal outcomes in parturients with total labor >24 hours, and to explore labor management under the new labor model. Methods: This was a retrospective study. Clinical data were collected from parturients who underwent prenatal examination and delivery in the Obstetrics Department of the First Affiliated Hospital of Nanjing Medical University from January to December 2022. Forty singleton cephalic primiparous women with prolonged total labor were selected as the observation group (total labor >24 hours), and 95 singleton cephalic primiparous women with normal labor during the same period were selected as the control group (total labor $ $24 hours). The two groups were compared in terms of maternal age, BMI, gestational weeks at delivery, gestational diabetes mellitus, gestational hypertension, neonatal birth weight, labor conditions, rate of labor analgesia, and rate of labor intervention. Multivariate logistic regression analysis was used to explore risk factors for total labor >24 hours. Maternal-neonatal outcomes were compared between the two groups: presence of intrapartum fever, amniotic fluid contamination, episiotomy, operative vaginal delivery, cervical laceration, postpartum hemorrhage, manual removal of placenta, as well as fetal distress, neonatal asphyxia, and admission to neonatal intensive care unit (NICU). Results: There were no statistically significant differences between the two groups in maternal age, BMI, gestational weeks at delivery, gestational hypertension, gestational diabetes mellitus, or neonatal birth weight (P>0.05). The observation group had longer durations of first stage, second stage, and total labor, as well as higher

rates of labor analgesia and labor intervention than the control group (P<0.05). However, multivariate logistic regression analysis showed that neither labor analgesia nor labor intervention were influencing factors for total labor >24 hours (P>0.05). There were no statistically significant differences between the two groups in the incidence of postpartum hemorrhage, manual removal of placenta, or neonatal asphyxia (P>0.05). The observation group had higher incidences of intrapartum fever, amniotic fluid contamination, episiotomy, operative vaginal delivery, cervical laceration, fetal distress, and neonatal admission to NICU than the control group (P<0.05). No neonatal asphyxia occurred in either group. Conclusion: Due to prolonged labor, the rates of labor analgesia and labor intervention significantly increased during delivery in parturients with total labor >24 hours. Total labor >24 hours did not increase the incidence of maternal postpartum hemorrhage, manual removal of placenta, or neonatal asphyxia, but did increase the probability of maternal intrapartum fever, amniotic fluid contamination, episiotomy, operative vaginal delivery, cervical laceration, fetal distress, and neonatal admission to NICU. Obstetricians should pay attention to adverse maternal-neonatal outcomes caused by prolonged labor and manage labor individually.

Full Text

Risk Factors and Maternal and Neonatal Outcomes of Pregnant Women with Total Labor over 24 Hours

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Abstract

Background: Standardized labor management is crucial for ensuring maternal and neonatal safety. Since the publication of the new labor standards, the concept of prolonged labor has been de-emphasized, and minimal intervention during labor is now recommended. Consequently, the number of parturients with total labor exceeding 24 hours has increased compared to previous periods.

Objective: To analyze the risk factors and maternal/neonatal outcomes in women with total labor >24 hours and to explore labor management strategies under the new labor standards.

Methods: This retrospective study collected clinical data from parturients who received prenatal care and delivered at the Department of Obstetrics, First

Affiliated Hospital of Nanjing Medical University from January to December 2022. Forty nulliparous women with singleton cephalic presentation and prolonged total labor (>24 h) were selected as the observation group, while 95 nulliparous women with singleton cephalic presentation and normal total labor ($ $24 h) who delivered during the same period served as the control group. The two groups were compared regarding maternal age, BMI, gestational age at delivery, gestational diabetes mellitus, gestational hypertension, neonatal birth weight, labor characteristics, labor analgesia rate, and labor intervention rate. Multivariate logistic regression analysis was used to identify risk factors for total labor >24 h. Maternal and neonatal outcomes were compared between groups, including intrapartum fever, amniotic fluid contamination, episiotomy, operative vaginal delivery, cervical laceration, postpartum hemorrhage, manual placental removal, fetal distress, neonatal asphyxia, and neonatal intensive care unit (NICU) admission.

Results: No significant differences were observed between the two groups in maternal age, BMI, gestational age, gestational hypertension, gestational diabetes, or neonatal birth weight (P>0.05). The observation group had significantly longer first stage, second stage, and total labor duration, as well as higher rates of labor analgesia and labor intervention (P<0.05). However, multivariate logistic regression analysis revealed that neither labor analgesia nor labor intervention were independent risk factors for total labor >24 h (P>0.05). There were no significant differences in postpartum hemorrhage, manual placental removal, or neonatal asphyxia rates between groups (P>0.05). The observation group showed significantly higher incidences of intrapartum fever, amniotic fluid contamination, episiotomy, operative vaginal delivery, cervical laceration, fetal distress, and NICU admission (P<0.05). No neonatal asphyxia occurred in either group.

Conclusion: Due to prolonged labor, the rates of labor analgesia and labor intervention increase significantly in women with total labor >24 h. While prolonged labor does not increase the incidence of postpartum hemorrhage, manual placental removal, or neonatal asphyxia, it does increase the risk of intrapartum fever, amniotic fluid contamination, episiotomy, operative vaginal delivery, cervical laceration, fetal distress, and NICU admission. Obstetricians should pay close attention to adverse maternal and neonatal outcomes associated with prolonged labor and manage labor on an individualized basis.

Keywords: Parturition; Obstetric labor; Pregnancy outcome; Fetal distress; Management of labor stage; Labor analgesia; Labor intervention; Risk factors

Introduction

Total labor refers to the complete childbirth process, from the onset of regular uterine contractions to the delivery of the fetus and placenta, and consists of three stages: the first stage (cervical dilation), second stage (fetal expul-

sion), and third stage (placental expulsion). Labor management is essential for ensuring maternal and neonatal safety, and standardized, individualized labor management is the primary approach to improving outcomes.

China previously adopted the labor management model proposed by Friedman in 1954, which gained worldwide recognition. However, recent clinical practice has revealed that this model is no longer suitable for contemporary obstetrics due to increased maternal age at delivery, reduced physical labor, and widespread use of labor analgesia. In 2014, the Obstetrics Subgroup of the Chinese Society of Obstetrics and Gynecology published the *Expert Consensus on New Labor Standards and Management (2014)*, which was developed based on comprehensive review of domestic and international literature and guidelines from the Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD), American College of Obstetricians and Gynecologists (ACOG), and Society for Maternal-Fetal Medicine (SMFM).

Historically, total labor >24 h was diagnosed as prolonged labor and considered to lead to adverse pregnancy outcomes. However, the 2014 consensus de-emphasized the definition of prolonged labor and recommended minimizing labor interventions while substantially extending labor time limits, resulting in an increased number of parturients with total labor >24 h. This study analyzes women with total labor >24 h to evaluate the risk factors for prolonged labor and associated maternal/neonatal outcomes, aiming to provide guidance for clinical practice, individualized labor management, and reduction of adverse outcomes.

Methods

Study Subjects

This retrospective study selected 135 nulliparous women with singleton cephalic presentation who received regular prenatal care and delivered at the First Affiliated Hospital of Nanjing Medical University between January and December 2022. Participants were divided into an observation group (total labor >24 h, n=40) and a control group (total labor $ $24 h, n=95).

Inclusion criteria: (1) Singleton pregnancy; (2) Full-term delivery; (3) Nulliparous; (4) Labor managed according to the *Expert Consensus on New Labor Standards and Management (2014)*.

Exclusion criteria: (1) Cesarean delivery.

Data Collection

Maternal and neonatal clinical data were collected and recorded, including:

General characteristics: Maternal age, BMI, gestational age at delivery, gestational hypertension, gestational diabetes mellitus, neonatal birth weight.

Labor characteristics: Duration of first, second, and third labor stages; total labor duration; use of labor analgesia; labor interventions (including intravenous diazepam, intramuscular pethidine, phloroglucinol, oxytocin augmentation, and artificial rupture of membranes).

Maternal and neonatal outcomes: Intrapartum fever, amniotic fluid contamination, episiotomy, operative vaginal delivery, cervical laceration, postpartum hemorrhage, manual placental removal, fetal distress, neonatal asphyxia, and NICU admission.

Statistical Analysis

SPSS 23.0 software was used for statistical analysis. Normally distributed continuous variables are presented as mean ± standard deviation (x-±s) and compared using independent samples t-test. Non-normally distributed continuous variables are presented as median (interquartile range) [M(P25,P75)] and compared using Mann-Whitney U test. Categorical variables are presented as frequencies and percentages and compared using ^{2} test or Fisher' s exact test. Multivariate logistic regression analysis was performed to identify influencing factors for total labor >24 h. Statistical significance was set at $P<0.05$.

Results

General Characteristics

No significant differences were found between the two groups in maternal age, BMI, gestational age, gestational hypertension, gestational diabetes, or neonatal birth weight ($P>0.05$) .

Labor Characteristics

No significant difference was observed in third stage duration between groups ($P>0.05$). However, the observation group had significantly longer first stage, second stage, and total labor duration, as well as higher rates of labor analgesia and labor intervention compared to the control group ($P<0.05$) .

Multivariate Logistic Regression Analysis

Using total labor >24 h as the dependent variable (assignment: >24 h=1, $ $24 h=0) and clinical risk indicators with $P<0.1$ in Tables 1 and 2 (BMI, gestational age, neonatal birth weight, labor analgesia) as independent variables, multivariate logistic regression analysis showed that none of these factors were independent predictors of total labor >24 h ($P>0.05$) .

Maternal and Neonatal Outcomes

No significant differences were found between groups in postpartum hemorrhage, manual placental removal, or neonatal asphyxia rates ($P>0.05$). The observa-

tion group had significantly higher incidences of intrapartum fever, amniotic fluid contamination, episiotomy, operative vaginal delivery, cervical laceration, fetal distress, and NICU admission ($P<0.05$) . Among the 9 neonates transferred to NICU in the observation group, 4 had low pulse oximetry and 5 had tachypnea, all with good prognoses.

Discussion

In 2014, the Obstetrics Subgroup of the Chinese Society of Obstetrics and Gynecology issued guidelines that de-emphasized the definition of prolonged labor and advocated for minimal intervention when maternal and fetal conditions permitted, leading to an increased number of parturients with total labor >24 h. Although the concept of prolonged labor is no longer emphasized, excessively long labor may still result in adverse maternal and neonatal outcomes. To evaluate the impact of prolonged labor on outcomes, this study analyzed the risk factors and maternal/neonatal outcomes in women with total labor >24 h to further standardize labor management.

This study compared general characteristics between groups, including maternal age, BMI, gestational age, gestational hypertension, gestational diabetes, and neonatal birth weight, finding no significant differences. Logistic regression analysis also indicated these were not risk factors for total labor >24 h. KHALIFA et al. [5] compared 174 women with normal BMI and 164 with high BMI, finding that high-BMI women who delivered vaginally had significantly increased neonatal birth weight and prolonged first and second stages, leading to increased risks of chorioamnionitis, cervical laceration, wound infection, and NICU admission. Our findings differ from this, while SHEN Nan et al. [6] reported no significant differences in maternal age, gestational age, BMI, gestational diabetes, gestational hypertension, premature rupture of membranes, or labor induction between groups with total labor >24 h and $ $24 h, consistent with our results.

Previous studies have shown that although labor analgesia significantly relieves maternal pain, it substantially increases the incidence of prolonged second stage, leading to adverse outcomes such as chorioamnionitis, cervical laceration, postpartum hemorrhage, and increased NICU admission rates and short-term neonatal morbidity [7-10]. SHEN Nan et al. [6] confirmed that labor analgesia is a risk factor for total labor >24 h. In our study, although the observation group had a significantly higher labor analgesia rate than the control group, multivariate logistic regression analysis revealed it was not an independent risk factor for total labor >24 h. This discrepancy may be due to selection bias from our relatively small sample size and requires further investigation. Clinically, close attention should still be paid to labor management after analgesia, particularly during the second stage.

Additionally, our results showed that the observation group had a significantly higher labor intervention rate, likely because clinicians and midwives often im-

plement active interventions during actual labor management to reduce potential risks associated with prolonged labor, consistent with previous findings [6].

This study examined perinatal outcomes in nulliparous women with total labor >24 h. No significant differences were found in postpartum hemorrhage or manual placental removal rates between groups (P>0.05), while the observation group had significantly higher incidences of intrapartum fever, amniotic fluid contamination, episiotomy, operative vaginal delivery, and cervical laceration (P<0.05). Prolonged labor increases the likelihood of fever, amniotic fluid contamination, and fetal distress. When abnormalities occur, active intervention becomes necessary, often resulting in increased intervention rates, operative vaginal delivery rates, and episiotomy rates, consistent with MATTA et al. [11]. YAN Sisi et al. [12] demonstrated in 2016 that prolonged labor does not increase postpartum hemorrhage incidence, and our study similarly found no significant differences in postpartum hemorrhage or manual placental removal rates. This may be because prophylactic uterotonic agents administered immediately after delivery in prolonged labor cases substantially reduce postpartum hemorrhage and manual placental removal rates. Other studies have also found no significant changes in postpartum complication rates under the new labor standards for women with total labor >24 h [13].

Our results showed no neonatal asphyxia in either group, but significantly higher rates of fetal distress and NICU admission in the observation group (P<0.05). Among the 9 neonates transferred to NICU in the observation group (4 with low pulse oximetry, 5 with tachypnea), all had good prognoses and were discharged within one week. Thus, although prolonged labor increases the incidence of amniotic fluid contamination and fetal distress, it does not affect perinatal prognosis or outcomes, consistent with previous research [6,12-17].

In summary, under the new labor management model, extended labor duration significantly increases the incidence of intrapartum fever, amniotic fluid contamination, episiotomy, operative vaginal delivery, cervical laceration, fetal distress, and NICU admission, while showing no significant impact on postpartum hemorrhage, manual placental removal, or neonatal asphyxia rates. These findings suggest that obstetricians should closely monitor labor progress when total labor exceeds 24 h, strengthen interventions, actively promote labor progression, provide symptomatic treatment, ensure maternal psychological well-being, and prepare for assisted delivery and neonatal resuscitation to reduce adverse maternal and neonatal outcomes.

Funding

This study was supported by the Jiangsu Maternal and Child Health Research Project (F201921), the National Natural Science Foundation Youth Fund Cultivation Program of the First Affiliated Hospital of Nanjing Medical University (PY2021003), and the 2019 Jiangsu Provincial High-level Innovative and Entrepreneurial Talent Introduction Program (“Double Innovation Doctor” cate-

gory).

Author Contributions

LU Yihan: conceptualized the study, designed the research, implemented the study, and drafted the manuscript. WANG Jiwen and SUN Yue: created and prepared tables. FENG Runrun, HAN Yufei, and SONG Zhenzhen: collected and organized data and performed statistical analysis. SUN Ying and DAI Huihua: revised the manuscript. CHEN Xing: responsible for quality control, review, and overall supervision.

Conflict of Interest Statement: The authors declare no conflicts of interest.

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(Received: April 25, 2023; Revised: May 29, 2023)
(Editor: KANG Yanhui)

Note: Figure translations are in progress. See original paper for figures.