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The Relationship Duration of the Second Stage of Labor and Neonatal Apgar Score in the Primipara Women

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ABSTRACT

Background: Most complications and mortality of mother and neonate occur during after childbirth process. In the second stage of labor, such as prolonged uterine contractions, there is a possibility of reduced oxygen delivery to the fetus and fetal complications. This study aimed to investigate the relationship between the duration of the second stage of labor and neonatal Apgar score in primipara women. **Material and methods:** The design of this study was cross-sectional and was conducted on 228 primiparous women referred to the maternity ward of Ganjavian Hospital in Dezful City, in 2020. The data on the duration of the second stage of labor, the Apgar score of the first and fifth-minute neonates, the mother's age, and the weight of the neonate were retrospectively collected from the hospital records. One-way ANOVA and Pearson correlation tests were used to analyze the data using SPSS software version 16. **Results:** The mean age of mothers was 23.94±5.34 years. The mean time of the second stage of labor was 37.45 ± 7.72 minutes. Also, the mean Apgar scores of neonates in the first and fifth minutes were 8.65 ± 0.66 and 9.61 ± 0.78, respectively. There was a statistically significant relationship between the duration of the second labor stage and the neonates' Apgar score in the first minute (P-value = 0.04) and the fifth minute (P-value = 0.03). There was also a statistically significant relationship between maternal age and Apgar score of the first minute (P-value = 0.02), fifth minutes (P-value = 0.03), and neonate weight (P-value = 0.01). **Conclusion:** The prolongation of the second stage of labor decreases the value of the neonatal Apgar score, which with proper management of the second stage of labor can prevent many complications in the mother and neonate.

Keywords: Second Stage of Labor, Apgar Score, NICU, Neonate.

BACKGROUND

During childbirth and the postpartum period, several complications can contribute to maternal and infant mortality. These vulnerable groups hold considerable significance in the health, socio-economic, and societal aspects. Labor encompasses four distinct stages, each requiring specific

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physiological functions and management [1]. Uterine contractions during labor induce cervical dilation, ultimately leading to the expulsion of the products of pregnancy [2,3]. In humans, the physiological stages of childbirth extend from the onset of cervical dilation to its completion [4]. The first stage of labor comprises the latent phase, which involves cervical effacement and early dilation, and the active phase, characterized by an accelerating rate of cervical dilation, typically from 5 to 6 cm [2,3]. The second stage commences upon complete cervical dilation and concludes with fetal delivery [4]. This stage involves intensified uterine contractions over an extended period, requiring patience and energy, particularly from the mother, and impacting the safe passage of the infant from the uterus [5]. Factors contributing to the prolonged duration of the second stage include incomplete cervical dilation, insufficient fetal movements necessary for passing through the birth canal, and the misalignment between the fetal head and the pelvis [4,5].

Delaying this stage can lead to complications for both the mother and the fetus, including uterine atony and post-delivery bleeding, perineal and reproductive system trauma, hypoxia, asphyxia, and other injuries for the baby [6,7]. Previous research has not yet determined the ideal duration for the second stage of labor [7,8]. The duration of the second stage of labor varies widely among women, with an average of about 50 minutes for primiparous women and 20 minutes for multiparous women [9]. A second stage lasting over two hours is classified as prolonged [8]. Overall, approximately 83.5% of cases of prolonged second-stage labor have been reported [10]. According to Torvalds et al., prolonging labor stages, specifically non-separation and coincident labor, is linked to Apgar scores below 7 [11]. The Apgar score serves as the established method for evaluating the immediate general health of newborns following delivery [12]. Despite being utilized for over 50 years, the Apgar scoring system continues to be the most effective means of predicting the prognosis of newborns post-birth [12,13]. A low first-minute Apgar score signals the requirement for resuscitation, while the score at the fifth minute offers greater precision in assessing the likelihood of both death and neurological complications in the infant [14]. Combining a low Apgar score with the severity of asphyxia has been suggested as the primary criteria for diagnosing severe asphyxia in newborns [15]. This score is derived from assessing five physiological indicators (heart rate, reflex, muscle tone, posture, and skin color) to gauge the infant's status during those critical initial moments [16,17]. Altman et al.'s research indicated that the elongation of the second stage of labor can be identified as a risk factor for lower Apgar scores at birth [18]. With a focus on the overall health of both the mother and baby, the investigation aims to establish the relationship between the duration of the second stage of labor and the infant's Apgar score. Should the study confirm a correlation between prolonged second-stage labor and the infant's Apgar score, it necessitates adequate preparation by medical staff and the delivery room for successful baby resuscitation.

MATERIAL AND METHODS

The cross-sectional study was designed to investigate primiparous women who were referred to Ganjovian Hospital in Dezful in 2018. The study included 228 primiparous women who were chosen using the census method in the obstetrics and gynecology department of Ganjovian Hospital in Dezful city from April 1st to the end of March 2018. The inclusion criteria for the study were primiparous women between the ages of 15 and 40. Exclusion criteria involved mothers with malignancies, babies with CDH congenital disorder, mothers with chronic heart, lung, cancer, or diabetes, mothers who consumed magnesium sulfate, preterm babies, and babies with macrosomia. The data used in the study was obtained from maternity hospital patient records. The maternity ward staff recorded key information like first-time mother age, newborn weight, second stage of labor duration, and Apgar scores at the first and fifth minutes post-birth. The second stage of labor is defined as full cervical dilatation to fetus delivery. Apgar scores range from zero to 10, with higher scores indicating better newborn health based on physiological indicators assessed at the first and fifth minutes after delivery.

Descriptive statistics utilized frequency and percentage for qualitative variables, and mean and standard deviation for quantitative variables. Analytical statistics included an independent T-test and Pearson's correlation coefficient. The normality of the data was assessed using the Kolmogorov-Smirnov test (P-value<0.05), leading to the application of parametric statistical tests. Data analysis was conducted using SPSS version 16 software, with a significance level of 0.05 established for this study. In discussing the ethical considerations of the research, approval was obtained from the ethics committee of Dezful University of Medical Sciences, with the assigned ethics committee code IR.DUMS.REC.1400.008. Additionally, patient data was collected without the inclusion of the patients' names.

RESULTS

The study included 228 mothers, with an average age of 23.94 ± 5.34 years, and their babies had an average weight of 3094.26 ± 448.66 grams. The average duration of the second stage of labor was 37.45 ± 7.72 minutes. Additionally, the average Apgar scores of the newborns at the first and fifth minute were 8.65 ± 0.66 and 9.61 ± 0.78, respectively. Regarding hospitalization, 31 newborns (13.60%) were admitted to the neonatal intensive care unit (NICU), while 197 babies (86.40%) did not require hospitalization. Table No. 1 presents the descriptive statistics and the statistical significance of the Apgar scores based on the duration of the second stage of labor.

Table 1. Status of the Apgar score of first and fifth minutes and according to the time of the second stage of labor in primiparous women

The second stage of labor (minutes)	n(%)	Apgar in 1st minute			Apgar in 5th minute		
		Mean	SD	P-value	Mean	SD	P-value
0-60	193(84.65)	8.98	0.65	0.04	9.84	0.79	0.03
60-120	27(11.84)	8.74	0.59		9.70	0.60	
>120	8(3.51)	8.02	0.75		9.01	0.91	
Total	228(100)	8.65	0.66		9.61	0.78	

Based on the findings presented in Table 1, it appeared that a longer second stage of labor is associated with a decrease in the average Apgar score at both the first and fifth minutes post-birth. Table 2 illustrates the correlation coefficient between several quantitative variables, including the duration of the second stage of labor, the Apgar scores at first and fifth minutes, the mother's age, and the weight of the babies under study.

Table 2. Correlation between the variables of the time of the second stage of labor, Apgar score of first and fifth minutes, mother's age, and weight of babies in primiparous women

Component/variables	Correlation/P-value	The time of the second stage of labor	Mother's age	Newborn weight
Apgar in 1st minute	r	-0.21	-0.18	0.4
	p-value	0.04	0.04	0.01
Apgar in 5th minute	r	-0.25	-0.08	0.42
	p-value	0.02	0.24	0.01
The time of the second stage of labor	r	1	0.02	-0.01
	p-value	-	0.081	0.98

Based on the findings presented in Table 2, there exists a statistically significant correlation between the Apgar score during the first and fifth minutes and the duration of the second stage in primiparous women. However, no statistically significant correlation was found between the duration of the second stage of labor, the age of the mother, and the weight of the baby. Table 3 provides an overview of the Apgar score status during the first and fifth minutes, the duration of the second stage of labor, and the weight of the baby based on the age group of the mothers.

Table 3. Status of Apgar score first and fifth minutes, duration of second stage labor, and baby weight according to the age group of primiparous women

Group/variable	Mother's age groups (years)	Mean	SD	P-value
Apgar 1st minute	<25	8.90	0.40	0.02
	25-35	8.76	0.96	
	>35	8.02	0.34	
Apgar 5th minute	<25	9.85	0.45	0.03
	25-35	9.73	1.01	
	>35	9.09	0.39	
The time of the second stage of labor(minute)	<25	37.83	9.65	0.91
	25-35	37.02	4.73	
	>35	33.01	7.72	
Newborn weight (gram)	<25	3174.03	419.29	0.01
	25-35	3089.15	464.41	
	>35	2720.19	439.27	

Based on the findings presented in Table 3, it appears that there is a statistically significant correlation between the Apgar score during the first and fifth minutes and the duration of the second stage of labor in primiparous women. Conversely, there does not seem to be any statistically significant correlation between the duration of the second stage of labor, the age of the mother, and the weight of the baby. For further insights, Table 3 displays the Apgar score status during the first and fifth minutes, the duration of the second stage of labor, and the weight of the baby categorized by the age group of the mothers.

DISCUSSION

The study aimed to explore the correlation between the lengthening of the second stage of labor and the reduction in Apgar score during the first and fifth minutes of delivery. The study involved 228 newborns, and it was found that there was a significant statistical relationship between these two variables. Therefore, it can be concluded that if the second stage of labor is prolonged, it can adversely affect the Apgar score of the baby in the first and fifth minutes, leading to a decrease in the score. Since the lengthening of the second stage of labor can increase infant mortality, it is of utmost importance to manage this stage of labor properly [19].

Study conducted by Jani et al. examined 150 babies with a low Apgar score (a score less than 7) and 150 babies with a normal Apgar score. The results of the study showed that there is a strong relationship between the occurrence of a low Apgar score in the first minute and important fetal, neonatal, and maternal risk factors, such as prolonged labor, preterm labor, congenital anomalies, local anesthesia in cesarean delivery, vacuum delivery, abnormal positioning of the fetus, and premature rupture of the fetal membranes. However, the main and most common factor in the occurrence of low Apgar score in preterm delivery is general anesthesia during cesarean delivery and length of delivery time. This is in line with the results of the present study [20]. The Apgar score is influenced by many factors in addition to the duration of labor. In another study of 313 infants with a fifth-minute Apgar score below 7 and 313 infants with a fifth-minute Apgar score, it was observed that substandard care during delivery was present for two-thirds of the infants with an Apgar score below 7. The most important factors were the misinterpretation of CTG, lack of timely action, prolongation of the delivery time, and careless use of oxytocin [21].

Based on a study investigating the correlation between the second stage of labor and neonatal complications, it was found that a duration of more than 2 hours was considered a long second stage of labor. The study showed that the average duration of the second stage was 70 minutes, with 952 patients having a duration of less than 2 hours and 47 patients experiencing more than 4 hours. The results of the study revealed that a longer duration of the second stage of labor was associated with lower first and fifth-minute Apgar scores, more acidic pH of the umbilical artery, and a higher need for hospitalization of the baby in the intensive care

unit [22]. Additionally, there were complications related to the mother, such as high blood loss and a drop in maternal hemoglobin. Another cohort study focused on maternal and neonatal complications resulting from the second stage of labor on 15,759 full-term, cephalic, and singleton births. The study found that mothers whose second stage lasted more than 4 hours had an increased chance of perineal trauma in grades 3 and 4 and also reported more chorioamnionitis. The study concluded that a longer duration of the second stage was related to neonatal complications and caused an increase in maternal complications [23].

After reviewing various materials, it can be concluded that the duration of labor is influenced by several factors, including epidural anesthesia, oxytocin, the mother's position, the start time of pushing, and fluid intake during labor. For managing the second stage of labor, it is recommended to monitor the descent and health of the fetus, as well as the mother's condition, to prevent fatigue. This method is preferable compared to solely relying on the Friedman curve. Precise justification by delivery agents about monitoring the mother and baby during delivery is also essential in reducing complications [7,24]. While some researchers argue that the Apgar score is influenced by other factors besides the duration of labor, many others believe that these two variables are directly related and that prolonging the second stage of labor will lower the Apgar score. However, it's important to note that the Apgar score is also affected by other variables, including premature birth, multiple births, and premature rupture of membranes [15,24].

Our study showed that there was a significant difference in the Apgar scores at the first and fifth minutes, as well as the weight of the baby in primiparous mothers. However, there was no significant difference in the average length of the second stage of labor in mothers. In another study, factors affecting prolonged labor's second stage were analyzed by comparing 182 women with less than 2 hours of labor to 182 women with more than 2 hours of labor. Results indicated that a shorter second stage of labor was associated with lower age and weight of the baby [25]. The use of oxytocin and epidural anesthesia directly increased the duration of the second stage, which is consistent with the present study. Patterson et al. also found a direct relationship between maternal age, height, baby weight, and the duration of the second stage of labor [26]. Furthermore, premature birth, multiples, premature rupture of membranes, and maternal anemia were also found to decrease the Apgar score below 7 in the study conducted by Asadollahi et al. in 2022. The low weight of the baby at birth can also be a significant factor in decreasing the Apgar score, according to the findings of the present research [27].

It can be concluded that a longer second stage of labor and a drop in Apgar scores during the first and fifth minutes can increase the likelihood of complications and asphyxia in newborns. This, in turn, increases the chances of requiring hospitalization in a special care unit. It is important to note that the fifth-minute Apgar score is crucial in determining the overall condition of the baby and the need for hospitalization. Additionally, paying attention to the acidity of the umbilical artery blood can help predict potential neonatal complications [15,20].

CONCLUSION

As the second stage of labor extends, the Apgar score index of the newborn tends to decrease, leading to several outcomes for the mother and the baby. This can increase the risk of complications and even death before birth. Therefore, proper management of this stage is crucial. It is recommended to provide training to the staff and personnel of the maternity hospital to prevent complications associated with the prolongation of the second stage of labor. Moreover, future studies should also consider other factors besides the duration of the second stage of labor that may contribute to the reduction in the Apgar score.

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CONFLICTS OF INTEREST

It should be noted that there were no conflicts of interest among the authors of this article.

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