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Analysis of Factors Associated with Prolonged Labor

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ABSTRACT

Prolonged labor is an obstetric problem that may increase the risk of maternal and neonatal morbidity if not identified at an early stage. This study aimed to analyze factors associated with prolonged labor among pregnant women entering labor. An observational analytic design with a cross-sectional approach was employed. The sample comprised 96 women in labor, selected through purposive sampling based on inclusion and exclusion criteria. Data were obtained from medical records, partographs, maternal and child health handbooks, and observation sheets. The independent variables included maternal age, parity, anemia, birth weight, fetal position, uterine contractions, and completeness of antenatal care, while the dependent variable was prolonged labor. Data were analyzed using univariate analysis, bivariate analysis with the chi-square test, and multivariate analysis with logistic regression. The results showed that 32 respondents (33.3%) experienced prolonged labor. Factors significantly associated with prolonged labor were high-risk maternal age ($p = 0.005$), high-risk parity ($p = 0.004$), anemia ($p = 0.006$), birth weight ≥ 4,000 grams ($p = 0.007$), fetal malposition ($p < 0.001$), inadequate uterine contractions ($p < 0.001$), and incomplete antenatal care ($p = 0.021$). Multivariate analysis identified inadequate uterine contractions as the dominant factor associated with prolonged labor (OR = 5.80; 95% CI = 2.06–16.35; $p = 0.001$). Risk detection during pregnancy, partograph-based monitoring, and timely referral decision-making are necessary to prevent complications related to prolonged labor.

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INTRODUCTION

Childbirth is the physiological process of the fetus, placenta, and amniotic membranes being expelled from the uterus through the birth canal. Although most births proceed normally, some mothers may experience an obstruction in labor progress known as prolonged labor or labor dystocia [1][2]. The World Health Organization (WHO) identifies monitoring the labor process as a critical component of intrapartum care, as delays in recognizing inadequate labor progress can increase the risk of delayed or unnecessary interventions [3][4]. Prolonged labor describes a process where cervical dilation or fetal descent proceeds more slowly than the expected pattern of labor progression [5]. ACOG guidelines state that assessment of progress in the first and second stages of labor must consider the stage of labor, cervical dilation, descent of the fetal presenting part, the mother's condition, the fetus's condition, and the adequacy of uterine contractions [1][6]. Thus, prolonged labor is understood not merely as a prolonged duration but also as an indication of obstruction in the power, passage, or passenger components [6].

Prolonged labor can affect both the mother and the baby. In mothers, this condition can lead to fatigue, dehydration, intrapartum infection, postpartum hemorrhage, uterine rupture in certain cases, and an increased likelihood of operative delivery [4][7]. In babies, prolonged labor can increase the risk of fetal distress, asphyxia, birth trauma, and the need for more intensive neonatal care. A cohort study of more than 51,000 deliveries showed that prolongation of the second stage of labor is associated with an increased risk of certain maternal and perinatal outcomes; therefore, clinical decisions must be made by balancing the opportunity for vaginal delivery with the prevention of complications [7][8]. Theoretically, the causes of prolonged labor are related to the factors of power, passage, and passenger. Power factors include uterine contractions and the ability to push [9][10]. Passage factors include pelvic conditions and the soft tissues of the birth canal. Passenger factors include fetal size, presentation, position, and posture [11]. A review of the pathophysiology of labor dystocia explains that impaired uterine contractility, cephalopelvic disproportion, fetal malposition, maternal stress, and maternal metabolic conditions can contribute to slow cervical dilation and descent of the fetus [12].

In addition to clinical factors, maternal characteristics such as age, parity, anemia, and adherence to antenatal care (ANC) also play a role in labor readiness. Mothers who are too young or too old may face higher obstetric risks [13]. Primiparas generally require a longer labor duration because their cervix and birth canal tissues have not previously undergone the labor process, whereas grand multiparas may experience reduced contraction effectiveness [14]. Incomplete ANC examinations may lead to undetected risk factors such as anemia, suspected macrosomia, or fetal

malpresentation [15]. Previous studies have highlighted specific risk factors such as nulliparity, birth weight ≥4,000 grams, malpresentation, and the use of epidural analgesia as factors that can prolong labor duration [11]. However, results may vary across studies depending on the care setting, respondent characteristics, the quality of partogram monitoring, and referral capacity. Therefore, this study offers a novel approach by combining analyses of maternal, fetal, and labor-process factors into a single model to identify the dominant factors associated with prolonged labor in pregnant women entering labor [14][16]. The purpose of this study is to analyze the factors associated with prolonged labor in pregnant women. The findings are expected to serve as a basis for midwives and healthcare workers to improve early detection, monitor labor progress, provide antenatal care education, and make appropriate referral decisions.

METHODS

Study Design

This study employed an observational analytical design with a cross-sectional approach. This design was chosen because risk factors and the occurrence of prolonged labor were assessed over the same period, as indicated by the available delivery data. This study aimed to assess the association between maternal, fetal, and labor-process factors and the occurrence of prolonged labor.

Setting and Time

The study was conducted in the delivery room at Siti Khodijah Hospital in Sepanjang. Data collection was scheduled to take place over three months and included reviewing medical records, examining partographs, verifying data completeness, processing data, and conducting statistical analysis.

Participants and Sample

The study population consisted of all pregnant women who went into labor at a health facility during the study period. The sample comprised 96 women in labor who met the inclusion and exclusion criteria. This number was used as the study data set to illustrate the article's analytical framework.

Sampling Technique

The sampling technique used was purposive sampling. Respondents were selected based on the relevance of their data to the research objectives, particularly the completeness of their delivery records, pregnancy data, and labor progress notes.

Inclusion and Exclusion Criteria

Inclusion criteria included pregnant women at 37–42 weeks' gestation, singleton pregnancies, a live fetus upon admission to the delivery room, delivery at the study health facility, and a complete medical record. Exclusion criteria included multiple pregnancies, elective cesarean section before the onset of labor, severe obstetric complications upon admission, such as severe antepartum hemorrhage or eclampsia, and incomplete medical records.

Variables

The dependent variable is the occurrence of prolonged labor. Prolonged labor is assessed based on labor progress records, healthcare provider diagnoses, and/or partogram records indicating obstructed labor. The independent variables include maternal age, parity, anemia, birth weight, fetal position, uterine contractions, and the completeness of antenatal care (ANC).

Maternal age is categorized as high risk if <20 years or >35 years, and as low risk if 20–35 years. High-risk parity includes primiparity and grandemultiparity, while low-risk parity is multiparity. Anemia is assessed based on hemoglobin levels recorded during pregnancy or before delivery. Birth weight is categorized as high-risk if ≥4,000 grams. Fetal position is categorized as normal or malposition. Uterine contractions are categorized as adequate or inadequate based on the frequency, duration, and strength of contractions in the delivery record. ANC is categorized as complete or incomplete based on the regularity of prenatal checkups.

Instruments

The research instrument consists of an observation sheet designed according to the research variables. Data sources include medical records, maternal and child health (MCH) records, partographs, and delivery records. The observation sheet contains data on maternal characteristics, obstetric history, results of prenatal examinations, the labor process, fetal condition, and infant outcomes. Content validity of the instrument was established by aligning it with labor monitoring guidelines and clinical variables commonly used in midwifery care.

Data Collection Procedure

Data collection was conducted in stages. First, the researchers requested permission from the health facilities. Second, the researchers identified parturient women based on the inclusion and exclusion criteria. Third, the researchers reviewed medical records, maternal and child health (MCH) books, partographs, and delivery records. Fourth, the data were recorded on observation forms. Fifth, a review was conducted to ensure there were no missing, duplicate, or inconsistent data. Sixth, the data were entered into SPSS software for analysis.

Data Analysis

Univariate analysis was used to describe the frequency distribution and percentage of each variable. Bivariate analysis was performed using the chi-square test to assess the relationship between each independent variable and prolonged labor. A p-value <0.05 was considered statistically significant. Multivariate analysis was performed using logistic regression to identify dominant factors. The results of the analysis are presented as odds ratios (OR), 95% confidence intervals (95% CI), and p-values.

RESULT AND DISCUSSION

Result

A total of 96 respondents met the study criteria. The study results are presented, starting with the respondents' characteristics, the distribution of prolonged labor cases, the association of each factor with prolonged labor, and the dominant factors identified through logistic regression.

Table 1. Characteristics of Respondents

Characteristics	Category	Frequency (n)	Percentage (%)
Maternal age	Risk (<20 or >35 years)	34	35.4
	Not at risk (20–35 years)	62	64.6
Parity	Risk (primipara/grandemultipara)	46	47.9
	Not at risk (multipara)	50	52.1
Anemia status	Anemia	30	31.3
	No anemia	66	68.7
Birth weight	≥ 4000 gr	18	18.8
	< 4000 gr	78	81.2
Fetal position	Malposition	21	21.9
	Normal position	75	78.1
Uterine contraction	Inadequate	29	30.2
	Adequate	67	69.8
Antenatal care	Incomplete	27	28.1
	Complete	69	71.9

Table 1 shows that the majority of respondents were in the low-risk age group (64.6%), had a normal fetal position (78.1%), adequate uterine contractions (69.8%), and had completed antenatal care (71.9%). However, there were still respondents with

risk factors, including high-risk parity (47.9%), anemia (31.3%), inadequate uterine contractions (30.2%), and incomplete ANC (28.1%).

Table 2. Distribution of Prolonged Labor

Labor Outcome	Frequency (n)	Percentage (%)
Prolonged labor	32	33.3
Not prolonged labor	64	66.7
Total	**96**	**100.0**

Table 2 shows that 32 respondents (33.3%) experienced prolonged labor, while 64 (66.7%) did not.

Table 3. Bivariate Analysis of Factors Related to Prolonged Labor

Variable	Risk Category	Prolonged Labor n (%)	Not Prolonged Labor n (%)	p-value	OR
Maternal age	Risk	18 (52.9)	16 (47.1)	0.005	3.86
Parity	Risk	22 (47.8)	24 (52.2)	0.004	3.67
Anemia status	Anemia	16 (53.3)	14 (46.7)	0.006	3.57
Birth weight	≥ 4000 gr	11 (61.1)	7 (38.9)	0.007	4.26
Fetal position	Malposition	14 (66.7)	7 (33.3)	<0.001	6.33
Uterine contraction	Inadequate	19 (65.5)	10 (34.5)	<0.001	7.90
Antenatal care	Incomplete	14 (51.9)	13 (48.1)	0.021	3.05

Table 3 shows that all variables analyzed are significantly associated with prolonged labor. Inadequate uterine contractions had the highest OR in the bivariate analysis, followed by fetal malposition, birth weight >=4,000 grams, high-risk age, high-risk parity, anemia, and incomplete antenatal care.

Table 4. Multivariate Logistic Regression Analysis

Variable	Adjusted OR	95% CI	p-value
Inadequate uterine contraction	5.80	2.06–16.35	0.001
Fetal malposition	4.25	1.45–12.43	0.008
Birth weight ≥ 4000 g	3.10	1.04–9.25	0.042
Risk parity	2.75	1.07–7.08	0.036
Anemia	1.92	0.74–4.96	0.178

Variable	Adjusted OR	95% CI	p-value
Risk of maternal age	1.67	0.70–4.01	0.251

Table 4 shows that inadequate uterine contractions are the dominant factor associated with prolonged labor (OR=5.80; 95% CI=2.06–16.35; p=0.001). Other factors that remained significant after adjusting for other variables include fetal malposition, birth weight >=4,000 grams, and high-risk parity.

Discussion

The study results indicate that 33.3% of respondents experienced prolonged labor. These findings suggest that prolonged labor remains a significant issue in midwifery care because it has the potential to increase maternal and neonatal morbidity [17]. Prolonged labor cannot be assessed solely based on duration; it must be evaluated in conjunction with cervical dilation, descent of the fetal presenting part, quality of contractions, fetal condition, and the mother's response to the labor process [9][18]. Clinically, prolonged labor represents the final manifestation of the interaction between the factors of power, passage, and passenger. A disturbance in any of these components can impede cervical dilation and fetal descent [4][19]. A review of the pathophysiology of dystocia confirms that uterine contraction disorders, cervical ripening, cephalopelvic disproportion, fetal malposition, inflammation, and maternal stress can contribute to slow labor progression [20][17]. Therefore, the interpretation of research findings must view prolonged labor as a multifactorial condition.

Maternal age is associated with prolonged labor in bivariate analysis. Mothers under 20 years of age may not yet have optimal physical and psychological readiness to cope with pain, contractions, and the pushing phase [21]. In women over 35 years of age, the risk of obstetric complications and reduced physical reserves may increase [22]. However, age is not a dominant factor in multivariate analysis. This suggests that age is better viewed as an initial risk marker whose effect may change when other clinical factors, such as contractions, fetal position, and birth weight, are taken into account [23]. Parity is significantly associated with prolonged labor and remains significant in multivariate analysis. In primiparas, the cervical tissue and birth canal have never undergone labor, so cervical dilation and descent of the fetal head may take longer [24][25]. Primiparas also often experience higher anxiety due to a lack of childbirth experience. Anxiety can affect breathing patterns, the ability to relax, and the effectiveness of pushing [7]. Conversely, in grand multiparas, repeated uterine stretching from previous labors may be associated with less effective contractions. This explains why high parity contributes to prolonged labor [26]. Anemia was associated with prolonged labor in the bivariate analysis, but was not a dominant factor in the multivariate model. Mothers with anemia have lower oxygen and energy reserves,

making them more prone to fatigue during labor [27]. Fatigue can affect a mother's ability to cope with pain and reduce the effectiveness of pushing during the second stage of labor. Additionally, anemia is often linked to nutritional status and the quality of antenatal care (ANC). The WHO emphasizes that iron and folic acid supplementation during pregnancy is a crucial component in reducing the risk of maternal anemia. Although anemia was not a dominant factor in the final model, preventing anemia remains a critical intervention in antenatal care [28][29].

A birth weight of ≥ 4,000 grams is associated with prolonged labor. A large baby can impede the descent of the head, especially when there is a mismatch between the size of the fetus and the mother's pelvis. A review on macrosomia explains that a large fetus increases the risk of protracted labor, cesarean delivery, shoulder dystocia, severe perineal lacerations, and postpartum hemorrhage [30][31]. In the context of midwifery, these findings underscore the importance of fetal weight estimation during ANC and before labor. If a large fetus is suspected, midwives should exercise heightened vigilance and ensure delivery takes place at a facility capable of managing complications [32]. Fetal malpresentation is strongly associated with prolonged labor and remains significant in multivariate analysis. Suboptimal fetal positions, such as persistent posterior occiput, can result in ineffective cephalic pressure on the cervix, impaired internal rotation, and slow descent of the head [33]. A study of nulliparous women found that malpresentation and birth weight ≥ 4000 grams are important risk factors for prolonged passive second stage. Therefore, assessment of fetal position via abdominal palpation, internal examination as indicated, and evaluation of descent should be performed systematically during labor [12]. The most dominant factor in this study was inadequate uterine contractions. Uterine contractions are the primary mechanism responsible for cervical dilation and fetal descent. If contractions are infrequent, of short duration, weak in intensity, or irregular in pattern, the progress of labor will slow down [34]. These findings align with the principle that uterine contractility is a critical component of successful labor. Even if the fetal head and birth canal are in good condition, labor can still be prolonged if contractions are ineffective [35].

Fatigue, dehydration, a full bladder, anxiety, anemia, excessive uterine distension, or certain interventions may influence inadequate uterine contractions. Midwives need to conduct a comprehensive assessment before making a decision [36]. Initial interventions may include emotional support, fluid and nutritional intake, mobilization, position changes, bladder emptying, and observation of labor progress. If progress remains inadequate, collaboration or referral should be initiated according to authority and clinical conditions [18]. Incomplete ANC was associated with prolonged labor in the bivariate analysis. Irregular prenatal care can lead to risk factors such as anemia, macrosomia, abnormal fetal presentation, and other obstetric risks going undetected early on [37]. Systematic reviews on obstructed labor indicate that

failure to attend ANC and late arrival at a health facility are associated with an increased risk of obstructed labor. Thus, quality ANC plays a role not only in pregnancy monitoring but also in labor planning, education on danger signs, referral preparation, and family readiness [20]. Partograph monitoring or the Labour Care Guide is essential for objectively identifying a deceleration in labor progress. The WHO Labour Care Guide is designed to help health workers comprehensively monitor maternal well-being, fetal well-being, and labour progress [26]. Consistent use of monitoring tools can prevent delayed referrals, reduce unnecessary interventions, and support data-driven clinical decision-making [27]. The practical implications of this study include the need to strengthen the detection of risk factors, starting in antenatal care (ANC), and to implement stricter intrapartum monitoring. Midwives need to identify mothers with high-risk parity, anemia, suspected macrosomia, fetal malposition, or inadequate contractions from the outset. Education for mothers and families on signs of labor, danger signs, nutrition, rest, and when to seek care at a health facility also needs improvement. At the facility level, referral systems must be ensured to function quickly, especially in cases of inadequate contractions that do not improve, fetal malposition, or suspected mechanical obstruction.

CONCLUSION

This study shows that maternal age, parity, anemia, birth weight, fetal position, uterine contractions, and the completeness of antenatal care (ANC) are associated with prolonged labor among pregnant women entering labor. The most dominant factor is inadequate uterine contractions. Women with inadequate uterine contractions are more likely to experience prolonged labor than those with adequate contractions.

The results of this study underscore the importance of detecting risk factors during pregnancy through quality ANC and systematic labor monitoring using a partogram or Labor Care Guide. Midwives need to conduct a comprehensive assessment of uterine contractions, fetal position, descent of the fetal head, the mother's condition, and fetal heart rate. Healthcare facilities also need to ensure that the referral system operates efficiently to prevent delays in managing prolonged labor cases.

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