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The correlation between premature rupture of membranes and first stage contractions with prolonged second stage of labor

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Abstract

Prolonged second stage of labor significantly contributes to maternal and fetal morbidity and mortality, often associated with risk factors like premature rupture of membranes (PROM) and inadequate first stage contractions. This study aimed to analyze the correlation between PROM and first stage contractions with the incidence of prolonged second stage of labor among delivering mothers at UOBF Montong Tuban Health Center. A correlational analytic study with a cross-sectional design was conducted in December 2023. The sample included 77 delivering mothers (October-December 2023 period) selected via simple random sampling. Independent variables (PROM and first stage contractions) and the dependent variable (prolonged second stage labor) were assessed using medical record data. Data analysis utilized the Contingency Coefficient test ($\alpha=0.05$). Results showed most respondents did not experience PROM (88.3%), had adequate first stage contractions (79.2%), and did not have prolonged second stage labor (77.9%). Statistical tests revealed highly significant correlations between both PROM ($p=0.000$) and first stage contractions ($p=0.000$) with prolonged second stage labor ($p < 0.05$). In conclusion, PROM and inadequate first stage contractions are significantly associated with prolonged second stage of labor at this facility. These findings can optimize risk screening, antenatal counseling, and labor preparation.

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INTRODUCTION

Childbirth is a physiological process, yet it carries risks of mortality and morbidity, particularly in developing countries (Muslimah & Handayani, 2023). One significant complication is prolonged second stage of labor, defined as the phase of fetal expulsion lasting more than two hours in primiparas and one hour in multiparas (Hayati et al., 2023). This condition contributes to both Maternal Mortality Rate (MMR) and fetal morbidity. World Health Organization (WHO) data indicates that prolonged labor accounts for 9% of maternal deaths, often linked to infections resulting from premature rupture of membranes (PROM) (Sari et al., 2023).

Premature Rupture of Membranes (PROM), the rupture of fetal membranes before the onset of labor, is a known risk factor for prolonged labor and infection (Sukmanawati et al., 2021; Tiruye et al., 2021; Diriba, Geda, & Wayessa, 2022; Telayneh et al., 2023; Xiao, & Lin, 2025). Pre-labor rupture can disrupt the lubrication of the birth canal (dry labor) and may lead to ineffective uterine contractions, culminating in prolonged labor (Septiana & Sapitri, 2022; Young, Marinescu, & Seligman, 2023; Razzaq, Kouira, & Al-Ogaili, 2024). Besides PROM, the quality of uterine contractions (His) during the first stage of labor is crucial. Inadequate contractions (insufficient strength or frequency) can impair efficient cervical dilation, hindering labor progress and potentially causing a prolonged second stage (Aristina & Diana, 2023).

Data from the UOBF Montong Tuban Health Center revealed an increase in PROM cases from 25.2% in 2022 to 28.6% in 2023. Concurrently, the incidence of prolonged second stage of labor significantly rose from 20.4% in 2021 to 34% in 2023. This trend necessitates further investigation into the factors associated with prolonged second stage of labor at this facility. Given the theoretical link between PROM and the quality of first stage contractions with the duration of the second stage, this study aimed to determine the correlation between premature rupture of membranes and first stage contractions with prolonged second stage of labor among delivering mothers at the UOBF Puskesmas Montong Tuban.

METHOD

This was a correlational analytic design with a cross-sectional approach. The research was conducted in December 2023 at the Functional Organizational Unit (UOBF) Montong Health Center, Tuban Regency. The population consisted of all mothers who delivered at the facility from October to December 2024, totaling 96 mothers. A sample size of 77 respondents was calculated using Slovin's formula with a significance level (d) of 0.05 and selected via simple random sampling. Inclusion criteria were: term pregnancy, no signs of fetal distress, and clear amniotic fluid. The exclusion criterion was delivering mothers with incomplete medical records.

The independent variables were Premature Rupture of Membranes (PROM) and First Stage Contractions. PROM was measured nominally (Yes/No) based on medical records (pervaginal fluid leakage before labor onset, positive litmus test). First Stage Contractions were measured ordinally (Adequate/Inadequate) based on the frequency (minimum 3 times per 10 minutes) and duration (minimum 40 seconds) of contractions recorded in the medical records. The dependent variable was Prolonged Second Stage of Labor, measured nominally (Yes/No) based on the duration of the second stage exceeding normal limits (more than 2 hours for primigravida, more than 1 hour for multigravida) as per medical records.

Data were collected from secondary sources, namely medical records and labor logbooks. Data analysis involved univariate analysis to describe the frequency distribution and percentage of each variable, and bivariate analysis using the Contingency Coefficient test via statistical software to determine the correlation between variables. The significance level was set at $\alpha = 0.05$. The null hypothesis (H_0) was rejected if the p-Value was < 0.05 ,

indicating a significant correlation. The study obtained permission from the relevant institution and adhered to research ethics, ensuring respondent anonymity and data confidentiality.

RESULTS AND DISCUSSION

Table 1. Distribution of Frequency of Age and Parity of Maternal Mothers at UOBF Montong Health Center from October to December 2024.

Distribution of Frequency	Total	Percentage (%)
Parity		
Primipara	30	39
Multipara	47	61
Large Multipara	0	0
Total	77	100
Age		
Age < 20 years old	17	22.1
Age 20-35 years old	54	70.1
Age > 35 years old	6	7.8
Total	77	100

Table 1 shows that out of the 77 respondents meeting the inclusion criteria, general characteristics showed that the majority were of reproductive age (20-35 years), accounting for 54 individuals (70.1%), and most were multiparous (having delivered previously), with 47 individuals (61%).

Table 2. Cross-tabulation of Premature Rupture of Membranes (PROM) with Prolonged Second Stage of Labor at UOBF Montong Health Center from October to December 2024.

Premature Rupture of Membranes (PROM)	Prolonged Second Stage of Labor				Total	Percentage (%)
	Yes		Not			
	n	%	n	%		
Yes	7	77.8	2	22.2	9	100
Not	10	14.7	58	85.3	68	100
Total	17	22.1	60	77.9	77	100

p-value = 0.00

Table 2 shows that the correlation between PROM and Prolonged Second Stage of Labor: Cross-tabulation analysis indicated that out of 9 respondents with PROM, 7 (77.8%) experienced a prolonged second stage. Conversely, out of 68 respondents without PROM, only 10 (14.7%) experienced a prolonged second stage. The Contingency Coefficient statistical test yielded a p-value = 0.000 ($p < 0.05$), leading to the rejection of H_0 . This indicates a statistically significant correlation between PROM and prolonged second stage of labor.

Table 3. Cross Table of First Stage Contractions with Prolonged Second Stage of Labor at UOBF Montong Health Center October to December 2024.

First Stage Contractions	Prolonged Second Stage of Labor				Total	Percentage (%)
	Yes		Not			
	n	%	n	%		
Adequate	3	4,9	58	95,1	61	100
Inadequate	14	87,5	2	12,5	16	100
Total	17	22,1	60	77,9	77	100

p-value = 0.00

Table 3 shows that the correlation between first stage contractions and Prolonged Second Stage of Labor Cross-tabulation analysis showed that out of 16 respondents with inadequate first stage contractions, 14 (87.5%) experienced a prolonged second stage. In contrast, out of 61 respondents with adequate first stage contractions, only 3 (4.9%) experienced a prolonged second stage. The Contingency Coefficient statistical test resulted in a p-value = 0.000 ($p < 0.05$). This demonstrates a statistically significant correlation between the quality of first stage contractions and prolonged second stage of labor.

DISCUSSION

This study identified significant correlations between both premature rupture of membranes (PROM) and the quality of first stage contractions with the occurrence of prolonged second stage of labor at the UOBF Montong Tuban Health Center.

The findings show that delivering mothers experiencing PROM had a higher risk of undergoing a prolonged second stage of labor ($p=0.000$). This aligns with theories suggesting that pre-labor membrane rupture can disrupt labor mechanisms. Without an intact amniotic sac, the hydrostatic function aiding cervical dilation is diminished, and the lack of fluid as a birth canal lubricant can lead to prolonged or "dry labor" (Aristina & Diana, 2023). An extended latent phase often occurs if PROM happens when the cervix is unripe (Noviyani & Ruliyah, 2023). Nevertheless, two PROM cases in this study did not result in prolonged second stage labor, both being multiparous women. This might suggest that in multiparas, prior birth experience and birth canal elasticity could potentially compensate for the effects of PROM (POGI, 2016). Conversely, 10 cases of prolonged labor occurred without PROM, predominantly in young primiparas, indicating that other factors like pushing effort and psychological state also play a role.

The research also confirmed a significant association between inadequate first stage contractions and prolonged second stage of labor ($p=0.000$). Uterine contractions are the primary 'power' driving fetal expulsion and cervical dilation (Ministry of Health of the Republic of Indonesia, 2015). Inadequate first stage contractions, whether in frequency, duration, or intensity, impede labor progress, potentially leading to a prolonged second stage (Sukmanawati et al., 2021). Most respondents had adequate contractions, possibly linked to the majority being in the optimal reproductive age group (Kusbandiyah, 2023). However, 14 out of 16 cases with inadequate contractions resulted in prolonged second stage labor, emphasizing the importance of contraction quality. Interestingly, 3 cases with adequate contractions still experienced prolonged labor, mainly young primiparas, likely due to factors like exhaustion or ineffective pushing techniques. Conversely, 2 cases with inadequate contractions in multigravidas did not have prolonged labor, possibly due to more effective pushing based on previous experience.

These findings underscore the importance of meticulous monitoring of membrane status and contraction quality during labor. Early interventions, such as labor augmentation for inadequate contractions or appropriate PROM management according to protocols, along with optimal labor support (emotional support, hydration, nutrition, positioning, relaxation, and correct pushing techniques), can help prevent prolonged second stage labor. Antenatal Care (ANC) counseling on warning signs like PROM and comprehensive physical and mental preparation for labor are crucial.

This study has limitations. Firstly, it was conducted at a single site, warranting caution in generalizing the results. Secondly, reliance on secondary data from medical records might be subject to limitations in completeness and recording accuracy. Thirdly, the study did not control for other confounding factors that could affect second stage duration, such as fetal weight, fetal position, maternal pelvic adequacy, and psychological factors.

CONCLUSION

Based on the research findings and data analysis, the following conclusions can be drawn that The majority of delivering mothers at UOBF Montong Tuban Health Center did not experience premature rupture of membranes, had adequate first stage contractions, and mostly did not experience prolonged second stage of labor. There is a statistically significant correlation between the occurrence of premature rupture of membranes and prolonged second stage of labor among delivering mothers at UOBF Montong Tuban Health Center ($p=0.000$). There is a statistically significant correlation between the quality of first stage contractions (adequate/inadequate) and prolonged second stage of labor among delivering mothers at UOBF Montong Tuban Health Center ($p=0.000$). Early identification of risk factors like PROM and monitoring the quality of first stage contractions are vital aspects of labor care to prevent prolonged second stage of labor and its associated complications.

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