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DETERMINANTS OF PROLONGED INDUCTION-TO-DELIVERY INTERVAL FOLLOWING MISOPROSTOL INDUCTION IN WOMEN WITH PRELABOR RUPTURE OF MEMBRANES

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ABSTRACT

Background: Prelabor rupture of membranes (PROM) frequently requires labor induction to reduce the risks associated with prolonged membrane rupture. Although misoprostol is an effective method for cervical ripening and labor induction in women with PROM, the duration of induction varies considerably between individuals. Identifying factors associated with prolonged induction-to-delivery interval may improve pre-induction counseling and clinical planning. This study aimed to determine the clinical and obstetric factors associated with prolonged induction-to-delivery interval among women with PROM undergoing misoprostol induction.

Methods: A single-center observational study was conducted among women with PROM undergoing misoprostol-induced labor at the study hospital between **January and June 2022**. Baseline maternal and obstetric characteristics, including maternal age, parity, gestational age, duration of membrane rupture before induction, and cervical favorability assessed using the Bishop score, were recorded. The primary outcome was induction-to-delivery interval, with prolonged induction defined according to the study protocol as an interval exceeding 18 hours**.** Associations between baseline characteristics and prolonged induction were assessed using appropriate univariable and multivariable statistical analyses. Induction-to-delivery interval was additionally evaluated as a continuous outcome.

Results: A total of **150** women were included in the analysis. Women with prolonged induction were more likely to have lower parity and a lower baseline Bishop score than those with shorter induction intervals. In multivariable analysis, increasing parity was associated with lower odds of prolonged induction, while a higher Bishop score was independently associated with a shorter induction-to-delivery interval. In the continuous analysis, both parity and Bishop score remained significantly associated with induction duration. Maternal age, gestational age, and duration of membrane rupture before induction were not independently associated with prolonged induction.

Conclusion: Among women with PROM undergoing misoprostol induction**,** lower parity and unfavorable cervical status at the initiation of induction were important determinants of a prolonged induction-to-delivery interval. Assessment of parity and Bishop score before induction may help clinicians anticipate induction duration and provide more individualized counseling. Further multicenter prospective studies are warranted to validate these findings and develop clinically useful prediction models for prolonged induction.

KEYWORDS: Prelabor rupture of membranes; PROM; misoprostol; labor induction; induction-to-delivery interval; Bishop score; parity; prolonged induction.

INTRODUCTION

Prelabor rupture of membranes (PROM), defined as rupture of the fetal membranes before the onset of labor, is a common obstetric condition with important implications for maternal and neonatal care. At term, PROM complicates approximately 8% of pregnancies, while preterm PROM accounts for a substantial proportion of preterm births. Once the membranes have ruptured, the balance between allowing spontaneous labor and proceeding with delivery becomes increasingly influenced by the duration of membrane rupture, gestational age, maternal and fetal condition, and the risk of infection. Prolonged rupture of membranes is associated with increasing maternal infectious morbidity and may also contribute to neonatal infectious and other adverse perinatal outcomes. Accordingly, contemporary guidance supports active management of term PROM rather than prolonged expectant management in appropriate candidates, with the objective of limiting unnecessary exposure to the consequences of prolonged membrane rupture while maintaining safe labor and delivery. [1–3]

For women with PROM in whom labor does not commence spontaneously, induction of labor is therefore frequently undertaken. The course of an induced labor, however, is not uniform and may vary substantially according to maternal and obstetric characteristics. Cervical favorability at the beginning of induction is particularly important because an unfavorable cervix generally requires a longer period of cervical ripening before

effective uterine contractions and active labor are established. Parity is another well-recognized determinant of labor progression, with nulliparous women generally requiring longer induction courses than multiparous women. Gestational age, duration of membrane rupture before induction, baseline cervical dilation, Bishop score, fetal and maternal characteristics, and the induction regimen itself may also contribute to variation in the time required to achieve delivery. Thus, understanding the factors associated with a prolonged induction course may be clinically relevant when counseling patients, planning monitoring, and allocating obstetric resources. [4–7]

Misoprostol, a synthetic prostaglandin E1 analogue, is widely used for cervical ripening and induction of labor because of its effectiveness, low cost, ease of administration, and relative stability at room temperature. These characteristics are particularly relevant in healthcare environments where access to more expensive or temperature-sensitive prostaglandin preparations may be limited. Evidence specific to term PROM suggests that oral misoprostol is an effective option for labor induction, although studies have used heterogeneous doses, routes, dosing intervals, and treatment protocols. A 2020 systematic review of 12 randomized trials involving 1,489 pregnancies concluded that oral misoprostol was an effective and apparently safe option for induction in term PROM, while emphasizing variability in dosing regimens and the need for greater standardization. Current WHO recommendations also support low-dose misoprostol for induction in women with a non-scarred uterus, while emphasizing appropriate maternal and fetal monitoring because of the risk of uterine hyperstimulation and associated fetal heart-rate abnormalities. [4,5] More recent randomized and observational studies have continued to demonstrate that misoprostol can achieve effective induction in PROM, although its relative effect on time to delivery compared with oxytocin has not been consistent across populations. [6–8]

The induction-to-delivery interval is an important clinical outcome in its own right and should not be regarded simply as a measure of procedural efficiency. A prolonged interval after induction may require extended maternal and fetal surveillance, increase use of labor-ward and inpatient resources, and prolong the period during which clinical decisions regarding augmentation, continuation of induction, or reassessment of maternal and fetal status are required. In women with PROM, the induction-to-delivery interval also contributes to the overall duration between membrane rupture and birth, although these two intervals should be distinguished because induction may begin at different times after membrane rupture. Recent evidence illustrates this distinction: a large 2025 cohort of women with term PROM and unfavorable cervices found that oral misoprostol was associated with a longer induction-to-delivery interval than intravenous oxytocin, while parity remained independently associated with the time from membrane rupture to delivery after adjustment for several covariates. [7] Similarly, an underpowered randomized trial published in 2024 among nulliparous women with PROM and an unfavorable cervix found no statistically significant overall difference in time from induction to delivery between oral misoprostol and oxytocin, highlighting the influence of population characteristics and baseline cervical status on induction duration. [8] Earlier PROM-specific evidence has also identified parity and Bishop score as important correlates of induction duration among women receiving oral misoprostol. [9]

Despite this growing evidence, important uncertainty remains regarding the determinants of prolonged induction-to-delivery interval specifically among women with PROM undergoing misoprostol induction. Existing studies have frequently been designed to compare misoprostol with oxytocin or other induction methods, to assess vaginal birth within a predefined time window, or to evaluate overall maternal and neonatal safety rather than to characterize the clinical factors associated with a prolonged induction course within a misoprostol-treated population. [4,6–8] The available evidence regarding parity and cervical favorability is also derived partly from older or relatively small studies, while more recent investigations have often included mixed induction methods or have focused on restricted populations such as nulliparous women with an unfavorable cervix. [7–9] Consequently, there remains limited contemporary evidence from real-world tertiary-care settings, particularly in South Asian populations, examining multiple maternal and obstetric characteristics simultaneously in relation to prolonged induction-to-delivery interval following misoprostol induction. A determinant-focused analysis may therefore provide clinically useful information for identifying women who are likely to require a longer induction course and for improving individualized counseling and management planning.

The present study was undertaken to identify the clinical and obstetric determinants of a prolonged induction-to-delivery interval among women with prelabor rupture of membranes undergoing misoprostol induction. Specifically, the study evaluates the association of available maternal and obstetric characteristics—including maternal age, parity, gestational age, baseline cervical status or Bishop score, duration of membrane rupture before induction, and characteristics of misoprostol administration—with the duration of induction until delivery. By focusing on the time from initiation of induction to delivery and its associated determinants, this study addresses a distinct clinical question from analyses centered on mode of delivery and seeks to provide evidence relevant to individualized prediction, counseling, monitoring, and resource planning in women with PROM undergoing misoprostol-based induction.

MATERIALS AND METHODS

This observational analytical study was conducted in the Department of Obstetrics and Gynaecology, Mardan Medical Complex, Mardan, Khyber Pakhtunkhwa, Pakistan, from **January 2022 to June 2022**. Mardan Medical Complex is a tertiary-care teaching hospital affiliated with Bacha Khan Medical College and provides obstetric services to women from Mardan and surrounding districts. The study included women with prelabor rupture of membranes (PROM) at term who underwent induction of labor with vaginal misoprostol according to the

institutional protocol. The present analysis was based on the clinical dataset generated during the original study of PROM managed with misoprostol induction and addressed a distinct research question, namely, the duration of induction-to-delivery and the maternal and obstetric factors associated with a prolonged induction course. The study was reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) recommendations.

Women were eligible if they were aged 18–40 years, had a viable singleton pregnancy at **≥37** completed weeks of gestation, cephalic fetal presentation, confirmed PROM, and no established spontaneous labor at presentation. Both nulliparous and multiparous women were included. Women with previous cesarean delivery or other uterine surgery, multiple pregnancy, malpresentation, placenta previa, antepartum hemorrhage, fetal distress at admission, clinical evidence of intra-amniotic infection, major fetal anomaly, contraindication to prostaglandin administration, or other contraindications to vaginal delivery were excluded. A total of 150 eligible women were included in the analysis.

PROM was diagnosed on the basis of a history of spontaneous leakage of amniotic fluid before the onset of regular uterine contractions, supported by clinical obstetric assessment. At admission, participants underwent routine maternal and fetal assessment, including vital signs, obstetric history, gestational age, fetal presentation, fetal heart-rate assessment, and evaluation for clinical evidence of infection or other contraindications to induction. Baseline cervical findings were assessed before induction where documented. The duration of membrane rupture before induction was calculated from the documented time of membrane rupture to administration of the first dose of misoprostol.

Labor was induced using 25 µg vaginal misoprostol administered at four-hour intervals**,** with a maximum of four doses, according to the institutional protocol. Before each subsequent dose, uterine activity and fetal status were reassessed. Further doses were withheld once adequate uterine activity or satisfactory labor progression had been established or when continued administration was clinically inappropriate. Maternal and fetal monitoring was performed throughout induction, and appropriate obstetric intervention was undertaken in the event of fetal compromise, uterine hyperstimulation, maternal complications, or other indications requiring discontinuation of induction. Women who required subsequent augmentation or other obstetric intervention were managed according to the attending obstetrician's clinical judgment and institutional labor-management protocol.

The primary outcome was the induction-to-delivery interval, defined as the elapsed time in hours between administration of the first dose of misoprostol and delivery. The starting point was therefore initiation of pharmacological induction rather than hospital admission or rupture of membranes. This distinction was maintained because PROM-to-delivery interval and induction-to-delivery interval represent different clinical periods. The induction-to-delivery interval was initially analyzed as a continuous outcome. For the determinant analysis, women were additionally categorized according to a prespecified clinically justified threshold into prolonged and non-prolonged induction groups. The threshold was defined independently of the observed associations to avoid outcome-driven categorization.

Potential determinants were selected a priori according to clinical relevance and availability in the dataset. These included maternal age, parity, gestational age, duration of membrane rupture before induction, baseline cervical status, and misoprostol exposure**,** including the number of doses administered where available. Baseline cervical status was represented by the Bishop score when completely documented; otherwise, individual recorded cervical parameters were considered. Variables occurring after initiation of induction, including oxytocin augmentation, mode of delivery, and intrapartum complications, were not considered baseline predictors because they may represent intermediate events or consequences of slow labor progression.

Clinical data were obtained from the structured study proforma and corresponding obstetric records and included demographic characteristics, obstetric history, gestational age, duration of membrane rupture, pre-induction findings, misoprostol administration, labor progression, delivery timing, and relevant maternal and neonatal outcomes. Particular attention was given to the chronological accuracy of membrane rupture, first misoprostol administration, subsequent dosing, and delivery times because these variables were required to calculate the primary outcome.

Statistical analysis was performed using IBM SPSS Statistics version 26.0. Continuous variables were summarized as mean ± standard deviation or median with interquartile range according to their distribution, while categorical variables were summarized as frequencies and percentages. The distribution of induction-to-delivery interval was assessed before selecting the appropriate analytical model. For comparisons between prolonged and non-prolonged induction groups, the independent-samples *t* test or Mann–Whitney *U* test was used for continuous variables, as appropriate, while categorical variables were compared using the chi-square or Fisher's exact test.

Univariable logistic regression was performed to assess associations between candidate predictors and prolonged induction-to-delivery interval. Variables considered clinically important a priori and/or showing evidence of association in univariable analysis were considered for multivariable logistic regression. Adjusted odds ratios (aORs) with **95%** confidence intervals (CIs) were reported. The final model was restricted according to the number of outcome events to minimize overfitting, and clinically related variables were assessed for multicollinearity. Model discrimination and calibration were evaluated using appropriate diagnostic measures.

Because dichotomization of a continuous time outcome may result in loss of information, the induction-to-delivery interval was also evaluated as a continuous outcome in a complementary multivariable analysis where

the distribution and sample size permitted. The regression approach was selected according to the distribution and assumptions of the outcome. Two-sided *p* values <0.05 were considered statistically significant.

The completeness of all variables was assessed before analysis. Analyses were based on available complete observations for individual variables when missingness was limited. Variables with substantial missing data were not included in multivariable models unless an appropriate missing-data strategy could be justified. No outcome values were imputed solely to increase the effective sample size.

Ethical approval for the original study was obtained from the relevant Institutional Ethical Review Committee of Mardan Medical Complex before commencement of the study. Written informed consent was obtained from participating women, and confidentiality was maintained throughout data collection and analysis. The dataset was anonymized for the present analysis. The current investigation focused specifically on induction-to-delivery interval and its determinants and therefore represents a distinct analytical objective from the previously published analysis of mode of delivery in the same clinical cohort.

RESULTS

A total of 150 women with prelabor rupture of membranes (PROM) undergoing misoprostol induction were included in the analysis. The mean maternal age was 30.18 ± 5.03 years**,** and the mean gestational age at induction was 38.92 ± 0.81 weeks**.** The mean duration of membrane rupture before induction was 23.45 ± 15.25 hours**,** while the mean baseline Bishop score was 5.57 ± 2.07**.** Baseline maternal, obstetric, and cervical characteristics of the study population are presented in Table 1**.**

Table 1. Baseline maternal, obstetric, and cervical characteristics of the study population

Characteristic	**Overall (N=150)**
Maternal age, years	30.18 ± 5.03
Gestational age, weeks	38.92 ± 0.81
Duration of ROM before induction, hours	23.45 ± 15.25
Parity	
0	51 (34.0%)
1	41 (27.3%)
2	33 (22.0%)
3	13 (8.7%)
≥4	12 (8.0%)
Previous vaginal delivery, n (%)	89 (59.3%)
Baseline cervical assessment	
Cervical dilation, cm	1.27 ± 0.70
Cervical effacement, %	51.43 ± 14.78
Bishop score	**5.57 ± 2.07**

Values are presented as mean ± standard deviation or n (%).

Abbreviation: ROM, rupture of membranes.

The mean induction-to-delivery interval was 13.40 ± 4.11 hours**,** with a median of 12.9 hours (IQR, 10.5–15.8). Using the predefined analytical threshold of ≥18 hours for prolonged induction, 22 women (14.7%) were classified as having a prolonged induction. Baseline characteristics according to induction duration are presented in **Table 2**.

Women with prolonged induction had significantly lower parity than those with an induction-to-delivery interval <18 hours **(**0.27 ± 0.77 vs. 1.47 ± 1.23; P<0.001**)** and a significantly lower baseline Bishop score **(**3.41 ± 1.68 vs. 5.95 ± 1.90; P<0.001). Previous vaginal delivery was also less frequent among women with prolonged induction **(**13.6% vs. 67.2%; P<0.001**).** Maternal age, gestational age, and duration of membrane rupture before induction did not differ significantly between the two groups (**Table 2**).

Table 2. Comparison of baseline characteristics according to induction-to-delivery interval

Variable	**<18 h (n=128)**	**≥18 h (n=22)**	***P***
Maternal age, years	29.95 ± 4.81	31.55 ± 6.14	0.256
Parity	**1.47 ± 1.23**	**0.27 ± 0.77**	**<0.001**
Gestational age, weeks	38.95 ± 0.82	38.80 ± 0.74	0.397
Duration of ROM before induction, hours	23.17 ± 14.44	25.09 ± 19.65	0.665

Variable	<18 h (n=128)	≥18 h (n=22)	*P*
Bishop score	**5.95 ± 1.90**	**3.41 ± 1.68**	**<0.001**
Previous vaginal delivery, n (%)	86 (67.2%)	3 (13.6%)	**<0.001**

Values are presented as mean ± standard deviation or n (%).
Abbreviation: ROM, rupture of membranes.

Univariable analysis

Univariable logistic regression demonstrated significant associations between prolonged induction and both parity and baseline Bishop score (**Table 3**). Increasing parity was associated with lower odds of prolonged induction, while a higher Bishop score was similarly associated with reduced odds. Maternal age, gestational age, and duration of membrane rupture before induction were not significantly associated with prolonged induction.

Table 3. Univariable logistic regression analysis of factors associated with prolonged induction

Predictor	Crude OR	95% CI	*P*
Maternal age (per year)	1.04	0.97–1.12	0.257
Parity (per unit increase)	**0.37**	**0.22–0.62**	**<0.001**
Gestational age (per week)	0.76	0.42–1.38	0.370
Duration of ROM (per hour)	1.01	0.99–1.03	0.259
Bishop score (per point)	**0.53**	**0.39–0.72**	**<0.001**

Abbreviations: OR, odds ratio; CI, confidence interval; ROM, rupture of membranes.
Prolonged induction was defined as an induction-to-delivery interval ≥18 hours.

Multivariable analysis

A multivariable logistic regression model incorporating maternal age, parity, duration of membrane rupture before induction, and baseline Bishop score was used to identify independent baseline determinants of prolonged induction (**Table 4**). After adjustment, both parity and Bishop score remained independently associated with the outcome.

Table 4. Multivariable logistic regression analysis of baseline determinants of prolonged induction

Predictor	Adjusted OR	95% CI	*P*
Maternal age (per year)	1.01	0.91–1.12	0.831
Parity (per unit increase)	**0.38**	**0.17–0.88**	**0.023**
Gestational age (per week)	0.73	0.36–1.49	0.387
Duration of ROM (per hour)	1.03	0.99–1.06	0.100
Bishop score (per point)	**0.54**	**0.37–0.79**	**0.001**

Abbreviations: OR, odds ratio; CI, confidence interval; ROM, rupture of membranes.
Prolonged induction was defined as an induction-to-delivery interval ≥18 hours. The model included maternal age, parity, gestational age, duration of ROM before induction, and baseline Bishop score.

Each one-unit increase in parity was associated with significantly lower odds of prolonged induction **(**adjusted odds ratio [aOR], 0.38; 95% CI, 0.17–0.88; P=0.023**).** Similarly, each one-point increase in Bishop score was associated with lower odds of prolonged induction **(**aOR, 0.54; 95% CI, 0.37–0.79; P=0.001**).** Neither maternal age **(**aOR, 1.01; 95% CI, 0.91–1.12; P=0.831**)** nor duration of membrane rupture before induction **(**aOR, 1.03; 95% CI, 0.99–1.06; P=0.100**)** demonstrated a statistically significant independent association with prolonged induction.

Continuous analysis of induction-to-delivery interval

To complement the binary analysis, induction-to-delivery interval was analyzed as a continuous outcome using multivariable linear regression (**Table 5**). The overall model explained approximately 34% of the variability in induction-to-delivery interval **(**R^2=0.341; adjusted R^2=0.323; P<0.001**).**

Table 5. Multivariable linear regression analysis of determinants of induction-to-delivery interval

Predictor	β (hours)	95% CI	*P*
Maternal age (per year)	0.08	−0.04 to 0.19	0.184
Parity (per unit increase)	**−0.48**	**−0.96 to −0.01**	**0.045**
Gestational age (per week)	−0.11	−0.79 to 0.58	0.757
Duration of ROM (per hour)	0.03	−0.01 to 0.07	0.086
Bishop score (per point)	**−0.98**	**−1.26 to −0.69**	**<0.001**

Model fit: $R^2 = 0.341$; adjusted $R^2 = 0.323$; $P < 0.001$.
Abbreviations: β, regression coefficient; CI, confidence interval; ROM, rupture of membranes.
The dependent variable was induction-to-delivery interval in hours. The model included maternal age, parity, gestational age, duration of ROM before induction, and baseline Bishop score.
Parity and Bishop score demonstrated independent inverse associations with induction duration. Each additional unit of parity was associated with an estimated 0.48-hour reduction in induction-to-delivery interval **(**β=−0.48 hours; 95% CI, −0.96 to −0.01; P=0.045**).** Each one-point increase in Bishop score was associated with an approximately 0.98-hour reduction in induction-to-delivery interval **(**β=−0.98 hours; 95% CI, −1.26 to −0.69; P<0.001**).** Maternal age and duration of membrane rupture were not independently associated with the continuous induction-to-delivery interval (**Table 5**).
Overall, the binary and continuous analyses demonstrated a consistent pattern in which lower parity and an unfavorable baseline cervical status were associated with longer induction-to-delivery intervals**.**

DISCUSSION

The present study evaluated clinical and obstetric determinants of prolonged induction-to-delivery interval among women with prelabor rupture of membranes undergoing misoprostol induction. The principal findings were that lower parity and a lower baseline Bishop score were independently associated with a longer induction-to-delivery interval. These associations remained evident when induction duration was analyzed both as a binary outcome and as a continuous measure. In contrast, maternal age, gestational age, and duration of membrane rupture before induction were not independently associated with prolonged induction. These findings suggest that cervical favorability and previous reproductive history may be more important determinants of induction duration than several other routinely recorded obstetric characteristics.
The strong inverse association between Bishop score and induction duration is consistent with previous evidence demonstrating the importance of cervical readiness in labor induction. A systematic review and meta-analysis of 59 studies found that higher Bishop scores were associated with greater likelihood of successful induction and a shorter induction-to-vaginal-delivery interval [10]. More recent evidence has continued to support the prognostic value of the Bishop score, although its predictive performance varies across populations and it should not be regarded as an absolute predictor of induction outcome [11]. The present findings extend this evidence to women with PROM undergoing misoprostol induction, suggesting that women who begin induction with a less favorable cervix may require a longer period of cervical ripening and subsequent labor progression.
Parity was also independently associated with induction duration**.** Increasing parity was associated with lower odds of prolonged induction and a shorter continuous induction-to-delivery interval. Previous research has demonstrated that parity contributes to variation in response to labor induction, with multiparous women generally progressing more rapidly than nulliparous women [12,13]. Evidence involving misoprostol induction similarly indicates that parity and cervical characteristics influence the response to induction [14,15]. This relationship may reflect differences in cervical remodeling and labor progression associated with previous childbirth. However, the observational nature of the present study means that the underlying biological mechanisms cannot be established.
The findings should also be interpreted in the context of the effectiveness of misoprostol in PROM**.** Randomized studies have demonstrated that misoprostol is an effective option for labor induction in women with term PROM, with some studies reporting shorter induction-to-delivery intervals compared with oxytocin [16,17]. Other trials have demonstrated that different misoprostol regimens can achieve effective induction, although induction duration varies according to dose, route, and administration interval [18]. More recently, a meta-analysis of 20 randomized controlled trials involving 2,980 women found that misoprostol significantly reduced the induction-to-delivery interval compared with oxytocin without significant differences in several major maternal and neonatal outcomes [19]. Thus, while misoprostol is an effective induction agent, the present findings highlight that individual response varies substantially even when the same induction strategy is used.
The importance of cervical status in PROM is further supported by studies specifically evaluating women with an unfavorable cervix. Oral misoprostol has been shown to facilitate labor induction and reduce the time to delivery in women with term PROM and an unfavorable cervix [20]. Similarly, randomized comparisons of misoprostol with alternative induction strategies have demonstrated clinically meaningful differences in induction-to-delivery duration [21]. These findings are consistent with the present observation that women with lower Bishop scores were more likely to experience prolonged induction. A less favorable cervix may require additional time for cervical ripening before effective labor becomes established; therefore, prolonged induction should not necessarily be interpreted as pharmacological failure when maternal and fetal conditions remain reassuring.
Interestingly, duration of membrane rupture before induction was not independently associated with prolonged induction in the present study. This should not be interpreted as evidence that rupture duration is clinically unimportant, because prolonged membrane rupture remains relevant to infectious risk and decisions regarding timing of delivery. Rather, cervical status at the beginning of induction may have a more direct relationship with subsequent induction duration than the elapsed time since membrane rupture. Previous PROM research has identified cervical and uterine characteristics as important determinants of progression toward labor [22]. Differences between studies may also result from variations in parity, gestational age, cervical status, timing of induction, antibiotic practices, and induction protocols.

An important consideration is the distinction between baseline determinants and variables occurring during induction**.** Variables such as the number of misoprostol doses or subsequent oxytocin augmentation may be associated with longer induction, but they occur after induction has commenced and may themselves reflect delayed cervical or labor progression. Including such variables as baseline predictors could therefore introduce temporal ambiguity. The present analysis consequently focused on characteristics available before or at initiation of induction. This approach is supported by emerging research on prediction of induction duration. A recent systematic review found that Bishop score, parity, body mass index, and gestational age were among commonly evaluated predictors, but also identified substantial methodological limitations and limited external validation of existing prediction models [23].

These findings may have practical implications for pre-induction counseling and clinical planning**.** Assessment of parity and cervical favorability before initiating misoprostol may help clinicians anticipate women who are more likely to require a longer induction and provide more realistic expectations regarding the time to delivery. Such information may also assist with monitoring and resource planning in busy tertiary-care obstetric units. However, the findings should not be interpreted as establishing a specific Bishop-score threshold or parity-based rule for selecting or withholding induction. The Bishop score has useful prognostic value but imperfect predictive accuracy [11], and clinical decisions should continue to incorporate the overall maternal and fetal condition.

The study has several strengths. It examined a clearly defined outcome that is distinct from mode of delivery**,** allowing assessment of a clinically meaningful aspect of induction response. Induction duration was evaluated both as a continuous variable and as prolonged versus non-prolonged induction, providing complementary analyses. The multivariable analysis focused on clinically available baseline characteristics, reducing temporal ambiguity. Nevertheless, the single-center design and modest sample size limit generalizability, while the observational design prevents causal inference. The relatively small number of women with prolonged induction may also reduce the precision of regression estimates. Furthermore, the 18-hour definition of prolonged induction should be interpreted cautiously because definitions vary between studies, and Bishop score assessment may be subject to inter-observer variation.

Overall, the present study demonstrates that lower parity and lower baseline Bishop score are important determinants of prolonged induction-to-delivery interval among women with PROM undergoing misoprostol induction**.** Maternal age, gestational age, and duration of membrane rupture were not independently associated with prolonged induction in this cohort. These findings complement existing evidence on misoprostol by focusing specifically on patient-level determinants of induction duration rather than mode of delivery or comparison between induction agents. Future multicenter prospective studies should validate these associations and determine whether a combination of readily available baseline characteristics can reliably identify women at increased risk of prolonged induction.

CONCLUSION

The present study demonstrates that lower parity and unfavorable baseline cervical status are independently associated with a prolonged induction-to-delivery interval among women with prelabor rupture of membranes undergoing misoprostol induction. Women with lower parity and lower Bishop scores were more likely to experience prolonged induction, while maternal age, gestational age, and duration of membrane rupture were not independently associated with induction duration. These findings suggest that readily available pre-induction characteristics, particularly parity and Bishop score, may help clinicians anticipate the expected duration of induction and provide more individualized counseling and clinical planning. However, given the observational, single-center design, these associations should not be interpreted as causal. Larger prospective multicenter studies are warranted to externally validate these findings and determine whether combinations of baseline clinical and cervical characteristics can support reliable prediction of prolonged induction in women with PROM.

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