



Fetomaternal Outcome of Intracervical Catheterization as a Method of Induction of Labour at Term in Pregnant Women

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ARTICLE INFO

Keywords: Foley Catheter, Labour Induction, Fetomaternal Outcomes, NICU Admission.

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Declaration

Authors' Contribution

All authors equally contributed to the study and approved the final manuscript

Conflict of Interest: No conflict of interest.

Funding: No funding received by the authors.

Article History

Received: 07-05-2025 Revised: 03-06-2025

Accepted: 16-06-2025 Published: 30-06-2025

ABSTRACT

Background: Mechanical induction of labor using an intracervical Foley catheter remains a widely adopted strategy, particularly in low-resource settings. While it is considered effective for cervical ripening, its impact on fetomaternal outcomes varies across populations and clinical contexts. Understanding the pattern of associated complications can inform safer obstetric practice. **Objective:** To determine the frequency of fetomaternal outcome in patients with intracervical catheterization as a method of induction of labour. **Study Design:** Descriptive cross-sectional study. **Duration and Place of Study:** Conducted from October 2024 to April 2025 at the Department of Obstetrics and Gynaecology, Khyber Teaching Hospital, Peshawar. **Methodology:** A total of 100 pregnant women aged 18–35 years with singleton cephalic pregnancies beyond 37 weeks and a Bishop score <6 were enrolled using non-probability consecutive sampling. Labour was induced using an 18 French Foley catheter, with continuous traction and regular monitoring until expulsion. Maternal outcomes assessed included chorioamnionitis and postpartum hemorrhage (PPH); neonatal outcomes included NICU admission, low Apgar score, and meconium aspiration syndrome (MAS). **Results:** The mean age of participants was 29.21 ± 3.29 years, with a mean gestational age of 39.54 ± 1.09 weeks and mean BMI of 25.74 ± 2.43 kg/m². Chorioamnionitis occurred in 12.0% of cases, PPH in 20.0%, NICU admission in 35.0%, low Apgar scores in 25.0%, and MAS in 19.0%. NICU admissions were significantly higher among women aged ≤ 30 years (42.2% vs. 22.2%, $p=0.045$), and low Apgar scores were significantly more frequent in rural residents compared to urban (36.2% vs. 15.1%, $p=0.015$). **Conclusion:** Intracervical Foley catheterization is a viable induction method, though certain complications such as NICU admissions and low Apgar scores are more common in specific demographic groups.

INTRODUCTION

Labour induction is deliberately stimulation of uterine contractions before spontaneous onset of labour with intent to achieve vaginal delivery.¹ Induction is initiated when risks of proceeding with pregnancy are overridden by benefits of delivering child.² Post-date pregnancy, premature rupture of membranes, medical illness in mother such as hypertension or diabetes, or intrauterine retardation of growth are some most common situations that require induction.³ Induction of labour is started after clinical assessment so that mother and infant are fine and cervix is prepared for induction.⁴

Several techniques are available to induce labour and can be broadly classified along pharmacologic and mechanical lines.⁵ The pharmacologic methods include prostaglandins (e.g., dinoprostone or misoprostol) and oxytocin infusions to soften the cervix and induce uterine contractions.⁶ The mechanical methods aim to cause

cervix dilation and include methods like membrane stripping, amniotomy, and balloon catheter usage.⁷ The choice of technique depends on such factors as condition of cervix (ideally through Bishop scoring), date of gestation, parity, condition of mother and fetus, and hospital policy.⁸

Intracervical catheterization by a balloon catheter, e.g., Foley catheter, is a prevalent mechanical method of labour induction and ripening of cervix.⁹ Insertion of a catheter through the cervix's canal and inflation of the balloon with saline to act upon the internal os to induce prostaglandin in situ release and mechanical dilation comprises the technique.⁷ The procedure is considered to be safe and cost-effective, particularly in circumstances with limited access to pharmacologic agents. The Foley catheter is associated with low uterine hyperstimulation risk when compared to pharmacologic agents and therefore is a desirable option in many clinical situations.¹⁰

Fetomaternal outcomes of intracervical catheterization are generally acceptable, with some complications being related to it.¹¹ The maternal complications are chorioamnionitis due to ascending infection, and postpartum haemorrhage when induction is prolonged or unsuccessful.¹² From the neonatal perspective, undesirable results are low Apgar scores, meconium aspiration syndrome, and need for neonatal intensive care unit admission.¹³ The risk of uterine hyperstimulation and resulting fetal distress, however, is smaller when contrasted with that of pharmacologic induction techniques.¹⁴ Intracervical catheterization, when properly monitored and used in appropriate clinical scenarios, offers a relatively safe method of induction with acceptable fetomaternal results.¹⁵

A study conducted by Gagnon J. et al. reported that among patients undergoing intracervical catheterization, the incidence of chorioamnionitis was 15%, postpartum haemorrhage 15%, neonatal intensive care unit (NICU) admission 31%, low Apgar score 20.3%, and meconium aspiration syndrome 15%.¹⁶

Labour induction is a common obstetric intervention, and technique selection has a significant impact on both fetal and maternal outcomes. Intracervical catheterization is becoming popular due to its mechanical nature and perceived safety profile; however, there is mixed evidence regarding its effectiveness and associated fetomaternal outcomes. A systematic examination of fetomaternal outcomes with intracervical catheterization should be performed to guide clinical practice, facilitate optimal patient safety, and provide recommendations to labour induction protocol policy. The present study attempts to fill knowledge gaps by creating robust data regarding maternal and neonatal morbidity for this technique.

METHODOLOGY

This descriptive study was conducted in the Department of Obstetrics and Gynaecology at Khyber Teaching Hospital, Peshawar, over a period extending from October 2024 to April 2025. A total of 100 women were enrolled. The sample size was calculated using WHO sample size software with a 95% confidence level, 7% margin of error, and an anticipated frequency of meconium aspiration syndrome of 15% among patients undergoing labour induction using intracervical catheterization.¹⁶

Participants were selected through non-probability consecutive sampling. Eligible subjects included women aged 18 to 35 years with singleton pregnancies beyond 37 weeks of gestation (confirmed by last menstrual period), in cephalic presentation, with a parity of at least one, and a Bishop score less than six on admission. Exclusion criteria encompassed history of intrauterine fetal demise, congenital anomalies, antepartum haemorrhage, placental abruption, prior uterine surgery, or clinically documented cephalopelvic disproportion.

After approval from the institutional ethics committee, women meeting the selection criteria were approached. Written informed consent was obtained after explaining the study objectives and potential benefits. Demographic and clinical information including age, gestational age, body mass index, parity, education level,

income, profession, and area of residence was recorded at the time of enrollment.

Labour induction was initiated using an 18 French Foley catheter inserted into the endocervical canal under direct visual guidance via per speculum examination. The catheter was advanced into the extra-amniotic space and the balloon was inflated with 35 mL of sterile saline. To maintain gentle and continuous traction, the catheter was taped to the inner thigh, with periodic adjustment of the tape position. The position and expulsion of the balloon were assessed every six hours by digital cervical examination. The catheter remained in place until it was expelled spontaneously.

Each patient was monitored continuously throughout labour and the postpartum period. After delivery, maternal and neonatal assessments were carried out by the respective specialists, with observation continued until hospital discharge. Maternal infection was identified when fever exceeding 100.4°F was recorded on two occasions at least one hour apart during labour, accompanied by maternal tachycardia above 120 beats per minute, fetal heart rate greater than 160–180 beats per minute, leukocyte count above 15,000–18,000/ μ L, and presence of purulent or malodorous vaginal discharge. Postpartum haemorrhage was defined as blood loss of at least 500 mL within 24 hours following vaginal delivery or 1000 mL following cesarean section. Blood volume was assessed using weight-based estimation of soaked pads, gauze, and blood clots, equating 1 mL to 1 gram.

Neonatal condition was evaluated at birth and during postnatal observation. Admission to the neonatal intensive care unit was recorded for any infant requiring specialized care after delivery. A low Apgar score was defined as a score below 5 at five minutes post-delivery. The presence of meconium aspiration syndrome was determined based on either audible coarse respiratory sounds upon chest auscultation or chest radiographic evidence of asymmetric, patchy opacities with pleural effusions.

Data were analysed using IBM SPSS version 26. Descriptive statistics were applied with categorical variables summarized as frequencies and percentages. Quantitative variables were presented as mean \pm standard deviation or median and interquartile range depending on the distribution, which was assessed using the Shapiro-Wilk test. Stratification was performed for potential effect modifiers including maternal age, gestational age, parity, socioeconomic status and residence. Statistical associations were evaluated using the chi-square test or Fisher's exact test, with a p-value of ≤ 0.05 considered statistically significant.

RESULTS

The demographic characteristics of the study participants showed a mean age of 29.21 \pm 3.29 years, mean gestational age of 39.54 \pm 1.09 weeks, mean parity of 2.58 \pm 1.20, and mean BMI of 25.74 \pm 2.43 kg/m². Among the participants, 47.0% resided in rural areas and 53.0% in urban areas. Socioeconomic distribution revealed 35.0% were from poor backgrounds, 47.0% from middle-class, and 18.0% from rich families (as shown in Table-I).

Table I*Patient Demographics*

Demographics	Mean ± SD / n (%)
Age (years)	29.21 ± 3.29
Gestational Age (weeks)	39.54 ± 1.09
Parity	2.58 ± 1.20
BMI (kg/m ²)	25.74 ± 2.43
Residential Status	
Rural	47 (47.0%)
Urban	53 (53.0%)
Socioeconomic Status	
Poor	35 (35.0%)
Middle	47 (47.0%)
Rich	18 (18.0%)

The fetomaternal outcomes following intracervical catheterization included chorioamnionitis in 12.0%, postpartum hemorrhage (PPH) in 20.0%, NICU admission in 35.0%, low Apgar scores in 25.0%, and meconium aspiration syndrome (MAS) in 19.0% of the cases (as shown in Table-II)

Table II*Frequency of fetomaternal outcomes of intracervical catheterization*

Fetomaternal outcomes	Frequency	% age
Chorioamnionitis	12	12.00%
PPH	20	20.00%
NICU Admission	35	35.00%
Low Apgar	25	25.00%
MAS	19	19.00%

Analysis of associations between demographic factors and fetomaternal outcomes revealed several notable patterns. Chorioamnionitis occurred in 12.5% of women aged ≤30 years and 11.1% of those >30 years, with no significant difference (p=1.000). Similarly, there were no significant associations with gestational age (≤39 weeks: 12.5% vs. >39 weeks: 11.5%, p=0.882), parity (≤3: 12.0% vs. >3: 12.0%, p=1.000), socioeconomic status (ranging from 5.6% to 14.9%, p=0.564), or residential status (rural: 8.5%, urban: 15.1%, p=0.368). For postpartum

Table III*Association of Demographic factors with fetomaternal outcomes*

Demographic Factors	Group	Yes n(%)	No n(%)	p-value
Chorioamnionitis				
Age (years)	≤30	8 (12.5%)	56 (87.5%)	1.000*
	>30	4 (11.1%)	32 (88.9%)	
Gestational Age (weeks)	≤39	6 (12.5%)	42 (87.5%)	0.882
	>39	6 (11.5%)	46 (88.5%)	
Parity	≤3	9 (12.0%)	66 (88.0%)	1.000*
	>3	3 (12.0%)	22 (88.0%)	
Socioeconomic Status	Poor	4 (11.4%)	31 (88.6%)	0.564*
	Middle	7 (14.9%)	40 (85.1%)	
	Rich	1 (5.6%)	17 (94.4%)	
Residential Status	Rural	4 (8.5%)	43 (91.5%)	0.368*
	Urban	8 (15.1%)	45 (84.9%)	
Postpartum Hemorrhage (PPH)				
Age (years)	≤30	11 (17.2%)	53 (82.8%)	0.349
	>30	9 (25.0%)	27 (75.0%)	
Gestational Age (weeks)	≤39	8 (16.7%)	40 (83.3%)	0.423
	>39	12 (23.1%)	40 (76.9%)	
Parity	≤3	12 (16.0%)	63 (84.0%)	0.083
	>3	8 (32.0%)	17 (68.0%)	
Socioeconomic Status	Poor	6 (17.1%)	29 (82.9%)	0.756*
	Middle	11 (23.4%)	36 (76.6%)	
	Rich	3 (16.7%)	15 (83.3%)	
Residential Status	Rural	12 (25.5%)	35 (74.5%)	0.193
	Urban	8 (15.1%)	45 (84.9%)	
NICU Admission				
Age (years)	≤30	27 (42.2%)	37 (57.8%)	0.045*

hemorrhage (PPH), the incidence was higher in women >30 years (25.0%) compared to ≤30 years (17.2%), but this was not statistically significant (p=0.349). PPH was also more frequent in women with gestational age >39 weeks (23.1% vs. 16.7%, p=0.423) and those with higher parity (>3: 32.0% vs. ≤3: 16.0%, p=0.083), though not reaching significance. Socioeconomic status and residence had no significant impact on PPH occurrence (p=0.756 and p=0.193, respectively).

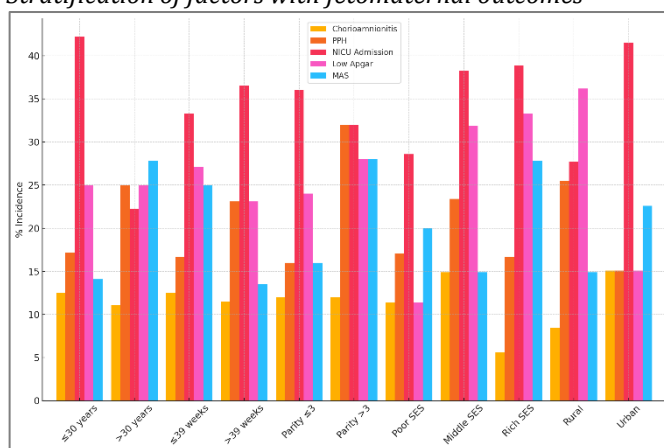
NICU admissions showed a statistically significant association with maternal age, being more common in the ≤30-year group (42.2%) compared to the >30-year group (22.2%, p=0.045). Other demographic factors such as gestational age (≤39 weeks: 33.3% vs. >39 weeks: 36.5%, p=0.737), parity (≤3: 36.0% vs. >3: 32.0%, p=0.717), socioeconomic status (28.6–38.9%, p=0.613), and residential status (rural: 27.7% vs. urban: 41.5%, p=0.147) were not significantly associated with NICU admission. Low Apgar scores were observed in 25.0% of both age groups (p=1.000), and showed no significant association with gestational age (≤39 weeks: 27.1% vs. >39 weeks: 23.1%, p=0.644), parity (≤3: 24.0% vs. >3: 28.0%, p=0.689), or socioeconomic status, although the trend suggested higher rates in middle and rich classes (p=0.066). Notably, a significant association was observed with residential status: low Apgar scores were more frequent in rural areas (36.2%) compared to urban areas (15.1%, p=0.015).

Regarding meconium aspiration syndrome (MAS), although incidence appeared higher in women aged >30 (27.8%) compared to ≤30 years (14.1%), the difference was not statistically significant (p=0.093). Similar non-significant trends were noted for gestational age (≤39 weeks: 25.0% vs. >39 weeks: 13.5%, p=0.142), parity (≤3: 16.0% vs. >3: 28.0%, p=0.185), socioeconomic status (p=0.466), and residence (rural: 14.9% vs. urban: 22.6%, p=0.324). (as shown in Table-III)

	>30	8 (22.2%)	28 (77.8%)	
Gestational Age (weeks)	≤39	16 (33.3%)	32 (66.7%)	0.737
	>39	19 (36.5%)	33 (63.5%)	
Parity	≤3	27 (36.0%)	48 (64.0%)	0.717
	>3	8 (32.0%)	17 (68.0%)	
Socioeconomic Status	Poor	10 (28.6%)	25 (71.4%)	0.613
	Middle	18 (38.3%)	29 (61.7%)	
	Rich	7 (38.9%)	11 (61.1%)	
Residential Status	Rural	13 (27.7%)	34 (72.3%)	0.147
	Urban	22 (41.5%)	31 (58.5%)	
Low Apgar Score				
Age (years)	≤30	16 (25.0%)	48 (75.0%)	1.000
	>30	9 (25.0%)	27 (75.0%)	
Gestational Age (weeks)	≤39	13 (27.1%)	35 (72.9%)	0.644
	>39	12 (23.1%)	40 (76.9%)	
Parity	≤3	18 (24.0%)	57 (76.0%)	0.689
	>3	7 (28.0%)	18 (72.0%)	
Socioeconomic Status	Poor	4 (11.4%)	31 (88.6%)	0.066*
	Middle	15 (31.9%)	32 (68.1%)	
	Rich	6 (33.3%)	12 (66.7%)	
Residential Status	Rural	17 (36.2%)	30 (63.8%)	0.015*
	Urban	8 (15.1%)	45 (84.9%)	
Meconium Aspiration Syndrome (MAS)				
Age (years)	≤30	9 (14.1%)	55 (85.9%)	0.093
	>30	10 (27.8%)	26 (72.2%)	
Gestational Age (weeks)	≤39	12 (25.0%)	36 (75.0%)	0.142
	>39	7 (13.5%)	45 (86.5%)	
Parity	≤3	12 (16.0%)	63 (84.0%)	0.185
	>3	7 (28.0%)	18 (72.0%)	
Socioeconomic Status	Poor	7 (20.0%)	28 (80.0%)	0.466*
	Middle	7 (14.9%)	40 (85.1%)	
	Rich	5 (27.8%)	13 (72.2%)	
Residential Status	Rural	7 (14.9%)	40 (85.1%)	0.324
	Urban	12 (22.6%)	41 (77.4%)	

Graph I

Stratification of factors with fetomaternal outcomes



DISCUSSION

The findings revealed that NICU admissions were significantly higher among younger mothers, which may be attributed to relatively immature physiological adaptation to labor stress or increased prevalence of unrecognized obstetric risk factors in this age group. The significantly higher incidence of low Apgar scores in neonates from rural areas may reflect limited access to timely intrapartum interventions and suboptimal neonatal resuscitation services. Although postpartum hemorrhage was more frequent among multiparous women, this could be explained by uterine muscle fatigue or atony associated with repeated pregnancies. The lack of significant associations between demographic variables and chorioamnionitis or MAS suggests that these outcomes are likely influenced more by procedural duration, aseptic

technique, and individual labor course rather than baseline maternal characteristics. These observations underscore the importance of individualized monitoring during labor induction, particularly in younger and rural populations.

Our cohort had a mean maternal age of 29.21 ± 3.29 years, mean gestational age of 39.54 ± 1.09 weeks, and mean BMI of 25.74 ± 2.43 kg/m², which was slightly higher than that reported in studies by Deshmukh et al. [16] and Alam et al. [17], where participants were predominantly in their early twenties with similar gestational durations. Parity and socioeconomic characteristics in our study were also broadly aligned with those in these reports, reflecting comparable obstetric populations in low-resource settings.

Our observed incidence of chorioamnionitis (12.0%) is higher than that reported by Doly et al. [18], who noted a 4% rate in women with previous cesarean and intrauterine fetal demise (IUFD), possibly due to heightened clinical vigilance and shorter induction durations in their cohort. Conversely, studies utilizing pharmacological agents such as dinoprostone or misoprostol, including Manasa et al. [19], reported even lower infection-related outcomes, with fetal morbidity rates as low as 5–10%. These differences support the hypothesis that mechanical induction methods like Foley catheter may carry increased risk of ascending infection, particularly when labor duration is prolonged or aseptic protocols vary.

Postpartum hemorrhage (PPH) occurred in 20.0% of our participants. This closely matches the findings by Manasa et al. [19], who reported maternal morbidity at 25% in the Foley catheter group, significantly higher than

in pharmacologic groups, highlighting the tendency of mechanical methods to result in prolonged labor and higher bleeding risks. Bhatu et al. [21] demonstrated a lower PPH rate in the Foley traction group compared to the non-traction group (20% vs. 29.2%), suggesting that controlled traction may enhance cervical ripening and reduce labor stress, thereby indirectly mitigating hemorrhagic complications.

NICU admission in our cohort was reported in 35.0% of neonates, significantly associated with younger maternal age (≤ 30 years, $p=0.045$). This is consistent with the trends observed by Lawani et al. [20], where mechanical and combined induction methods led to high NICU admissions due to labor complications and fetal distress. In contrast, studies favoring pharmacologic agents, such as Manasa et al. [19], showed markedly lower NICU admission rates, reflecting better labor efficiency and shorter exposure to intrauterine stress. The higher NICU rate in our study could also be partially attributed to institutional thresholds for NICU transfer and broader inclusion criteria.

Low Apgar scores were observed in 25.0% of neonates in our study, with significantly higher rates in rural populations (36.2% vs. 15.1%, $p=0.015$). This geographic disparity was not explicitly addressed in previous literature but is plausibly linked to delayed access to healthcare, suboptimal antenatal follow-up, or differences in intrapartum monitoring. In contrast, studies like Manasa et al. [19] reported low Apgar rates of 5–10%, likely due to prompt labor progression and more frequent use of pharmacologic methods. These differences emphasize how both the induction method and healthcare infrastructure influence neonatal outcomes.

The incidence of meconium aspiration syndrome (MAS) in our study was 19.0%, with higher though non-significant rates among women >30 years, multiparous women, and those residing in urban areas. This finding aligns with Alam et al. [17], who observed MAS rates ranging from 10–15%, and Manasa et al. [19], who noted just 5% in the dinoprostone group. The elevated rate in our cohort may be attributed to prolonged labor duration and slower progression in mechanical inductions, allowing more time for meconium passage and aspiration.

Across studies using Foley catheter alone, including those by Deshmukh [16], Alam [17], and Manasa [19],

results demonstrated prolonged induction-to-delivery intervals, higher oxytocin augmentation, and increased maternal morbidity, which support the trends we observed. In contrast, pharmacologic methods consistently showed improved Bishop scores, shorter labor, and better maternal-neonatal outcomes. Although our findings affirm the safety and feasibility of intracervical catheterization, particularly in low-resource settings, they also highlight that it may be associated with increased complications unless closely monitored and appropriately modified, such as by applying controlled traction as proposed by Bhatu et al. [21].

This study is subject to several limitations. It was conducted at a single tertiary care center, which may limit the generalizability of the findings to other populations or healthcare settings. The relatively small sample size may have reduced the power to detect certain associations, and the absence of long-term neonatal follow-up precludes conclusions about extended outcomes. Additionally, potential provider-related variations in induction technique, monitoring, and intervention thresholds were not controlled, which could have influenced fetomaternal outcomes. Future multicenter studies with larger cohorts and standardized protocols are warranted to validate and expand upon these observations.

CONCLUSION

Our study has concluded that intracervical Foley catheterization is an effective method for labor induction, particularly in resource-constrained settings. While generally safe, it is associated with certain maternal and neonatal complications, notably in specific demographic groups. The outcomes underscore the importance of individualized monitoring and risk-based management during induction. Tailoring care based on maternal age, parity, residence, and other sociodemographic factors can help optimize fetomaternal outcomes following mechanical cervical ripening.

Acknowledgments

We sincerely appreciate the unwavering commitment of the medical team within the department, whose diligence in maintaining precise records and methodical patient data management has been invaluable.

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