



Role of Prostaglandin in Induction of Labor in Patients with Poor Bishop Score

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ABSTRACT

Background: Low Bishop score is a sign of an adverse cervix and is significantly linked to labor induction failure. Prostaglandins have been increasingly employed to address this dilemma as they induce cervical ripening and uterine contractility to enhance successful vaginal discharge. Creation of local evidence is necessary in order to authenticate their application in varied clinical scenarios. **Objective:** To evaluate the efficacy of prostaglandin for induction of labor in women presenting with a poor Bishop score. **Study Design:** Quasi-experimental study. **Duration and Place of Study:** The study was carried out from July 2024 to December 2024 at the Department of Obstetrics and Gynecology, Ayub Teaching Hospital, Abbottabad. **Methodology:** A total of 118 women aged 18 to 40 years with singleton pregnancies beyond 37 weeks and an unfavorable Bishop score of five or less were included. Exclusion criteria were previous cesarean section, contraindications to prostaglandin use, abnormal fetal presentation, uterine pathology, or non-reassuring fetal status. Labor was induced with intravaginal prostaglandin E2 gel, administered up to three times within 24 hours. Efficacy was defined as achievement of vaginal delivery within 24 hours after induction. **Results:** The mean age of participants was 28 years and the mean gestational age was 39 weeks. Among 118 cases, successful vaginal delivery occurred in 100 women (84.7%), while 18 women (15.3%) failed to respond to induction. No significant association was found between efficacy and demographic factors. **Conclusion:** Prostaglandin is an effective agent for labor induction in women with poor Bishop scores, achieving high rates of successful vaginal delivery.

INTRODUCTION

Bishop score is a standardized scoring system of parturition that is used to predict cervical favorable status and readiness to commence parturition.¹ It is quantitatively determined by an assessment of five parameters: dilatation of cervix, effacement of cervix, consistency of cervix, station of presenting part of cervix, and position of presenting part of cervix.² These parameters are scored in numbers and the summative score predicts a prevalence of successful commencing of labor.² A higher score of Bishop predicts a favorable cervix that is likely to have a spontaneous commencing of labor or successful drug commencing of labor.³ A low score of Bishop predicts an unfavorable cervix that inhibits ignition and progression of parturition.⁴ This score system not only assists the parturitions to determine probable ignitions of ignition but also assists to select ignition modality as well as pharmacological agents and therefore serves as a reliable predictor of parturitions outcome.⁴ When a patient presents a low Bishop score, labor induction is a critical clinical challenge rendered by cervical unfavourability.⁵ The low score reflects a

dialectologically closed cervix that is posterior in its location and only to a small extent dilated and unaffectedly dilated, decreasing the likelihood of successful inception and increasing that of strained labour or caesarean section.⁶ Spontaneous onset of parturition is highly unlikely in such situations and so an artificial initiation is required to promote the protection of the foetus as well as mother.⁷ Various methods are employed to initiate such patients, including mechanical methods such as balloon catheterization of a transcervical nature and drug agents such as oxytocin or prostaglandin.⁸ When cervical unripening is present, however, mechanical efforts and oxytocin initiation alone frequently prove ineffective to stimulate a good uterine activity.⁹ Thus, cervical ripening is the introduction of an initial and most important step to successful initiation in women found to have a low Bishop score.

Prostaglandins play a central role in labor induction in patients with a low Bishop score due to their direct action to ripen the cervix and to stimulate the contractility of the myometrium.¹⁰ These drugs, and especially the prostaglandin E1 and E2 receptor analogs, provoke

biochemical and structural transformations of the cervix such as degradation of collagen, hydration augmentation, and glycosaminoglycan changes that lead to dilatation and softening.¹¹ At the same time, they provoke regular rhythmical contractions of the uterus that favor labor progression once cervical changes have been established.¹² Clinical evidence proves that prostaglandins significantly improve oxytocin alone or all-combine induced labor success in women presenting cervical unfavorable status by decreasing induction to delivery duration and reducing cesarean section rates when compared to oxytocin alone.¹² Their two-in-one action—viz., cervical priming and uterine activity augmentation—makes prostaglandins pharmacological agents of first choice in cervical poorly scoring patients.¹³ Prostaglandins therefore constitute a cornerstone in medical labor induction. In a study by Kemp B, et al. has shown the efficacy of prostaglandin was 81.6% in induction of labor in patients with poor Bishop score.¹⁴

Such a study is worthwhile undertaking in Abbottabad because the area presents a heterogeneous obstetric pool of varied access to facilities providing maternal healthcare. Local hospitals routinely present women with unsuitable Bishop scores, but centrally localized evidence on the usefulness of prostaglandins in inducing labor is limited. Production of localized evidence will not only facilitate tailoring clinical decision-making to suit obstetricians in Abbottabad but will also facilitate maternal and neonatal improvement in comparable resource-constrained healthcare facilities.

METHODOLOGY

This quasi-experimental investigation was undertaken in the Department of Obstetrics and Gynecology at Ayub Teaching Hospital, Abbottabad, spanning the period from July 2024 to December 2024. A total of 118 participants were enrolled. The sample size was estimated using the World Health Organization statistical software, applying a 95% confidence interval, a 7% margin of error, and an anticipated efficacy rate of 81.6% for prostaglandins in induction of labor among women with low Bishop scores.¹⁴ A non-probability consecutive sampling approach was utilized to recruit participants.

Approval for the study was secured from the institutional review committee prior to commencement. Women aged between 18 and 40 years with singleton pregnancies confirmed by ultrasonography, gestational age beyond 37 weeks based on the last menstrual period, and any parity were considered eligible. Participants were included if they had a Bishop score of five or less at the time of induction, which was regarded as an unfavorable cervix. Women with contraindications to prostaglandins, prior uterine incisions including cesarean sections, congenital uterine malformations, non-vertex fetal presentation, abnormal fetal heart tracing with a Fischer score under seven, or evidence of uterine pathology were excluded. Prior to data collection, written informed consent was obtained after explaining the study purpose, potential risks, and anticipated benefits. Demographic details such as age, gestational age, parity, body mass index, educational attainment, socioeconomic category, and residential background were recorded. A detailed

obstetric history was taken, and each participant underwent relevant clinical examination. Induction was carried out by administering prostaglandin E2 in a 2 mg vaginal gel formulation. The application was repeated at intervals of 6 to 8 hours, up to three doses in a 24-hour period, until the cervix demonstrated ripening. Efficacy of treatment was defined as achievement of vaginal delivery within 24 hours following induction.

Data were processed using IBM SPSS version 26. Descriptive statistics were calculated, with means and standard deviations for normally distributed quantitative data, while median and interquartile ranges were reported for non-normally distributed variables, confirmed by the Shapiro–Wilk test. Categorical characteristics, including socioeconomic status, education level, residential category, and delivery outcome, were expressed as frequencies and percentages. Efficacy was further stratified across variables such as age, gestational age, parity, body mass index, and socioeconomic indicators. Post-stratification analysis was conducted using chi-square or Fisher's exact test, with p values ≤ 0.05 taken as statistically significant.

RESULTS

The study included 118 patients with a mean age of 28.00 ± 4.55 years and a mean gestational age of 39.08 ± 0.93 weeks. The mean parity was 2.09 ± 1.14 , and the mean body mass index was 24.26 ± 3.38 Kg/m². Regarding socioeconomic status, 52 patients (44.1%) belonged to the poor category, 52 patients (44.1%) were from the middle class, and 14 patients (11.9%) were classified as rich. The majority of patients, 80 (67.8%), resided in rural areas, while 38 patients (32.2%) were from urban areas (as shown in Table 1).

Table 1
Patient Demographics

Demographics	Mean \pm SD
Age (years)	28.00 \pm 4.55
Gestational Age (weeks)	39.08 \pm 0.93
Parity	2.09 \pm 1.14
BMI (Kg/m ²)	24.26 \pm 3.38
Socioeconomic Status	Poor n (%)
	Middle n (%)
	Rich n (%)
Residential Status	Rural n (%)
	Urban n (%)

The efficacy of prostaglandin in inducing labor was demonstrated in 100 patients (84.70%), while it was ineffective in 18 patients (15.30%) out of the total 118 cases (as shown in Table 2).

Table 2
Efficacy of Prostaglandin in Induction of Labor (n=118)

Efficacy	Frequency	%age
Yes	100	84.70%
No	18	15.30%
Total	118	100%

When analyzing the association between efficacy and demographic factors, the success rate among patients aged ≤ 30 years was 73 (81.1%) compared to 27 (96.4%) in

those aged >30 years, with a p-value of 0.069 using Fischer Exact Test. For gestational age, 43 patients (86.0%) with ≤39 weeks and 57 patients (83.8%) with >39 weeks showed efficacy, yielding a p-value of 0.745. Parity analysis revealed that 92 patients (83.6%) with parity ≤3 and 8 patients (100.0%) with parity >3 experienced successful induction, with a p-value of 0.357 using Fischer Exact Test. Body mass index demonstrated efficacy in 55 patients (79.7%) with BMI ≤25 Kg/m² and 45 patients (91.8%) with BMI >25 Kg/m², resulting in a p-value of 0.117 using Fischer Exact Test. Socioeconomic status showed success rates of 42 patients (80.8%) in the poor category, 44 patients (84.6%) in the middle class, and 14 patients (100.0%) in the rich category, with a p-value of 0.210. Residential status indicated that 65 rural patients (81.3%) and 35 urban patients (92.1%) achieved successful labor induction, with a p-value of 0.173 using Fischer Exact Test (as shown in Table 3).

Table 3
Association of Efficacy with Demographic Factors

Demographic Factors	Efficacy		p-value
	Yes n(%)	No n(%)	
Age (years)	≤30	73 (81.1%)	0.069*
	>30	27 (96.4%)	
Gestational Age (weeks)	≤39	43 (86.0%)	0.745
	>39	57 (83.8%)	
Parity	≤3	92 (83.6%)	0.357*
	>3	8 (100.0%)	
BMI (Kg/m ²)	≤25	55 (79.7%)	0.117*
	>25	45 (91.8%)	
Socioeconomic Status	Poor	42 (80.8%)	0.210
	Middle	44 (84.6%)	
	Rich	14 (100.0%)	
Residential Status	Rural	65 (81.3%)	0.173*
	Urban	35 (92.1%)	

*Fischer Exact Test

DISCUSSION

The present study was conducted to evaluate the role of prostaglandin in induction of labor among patients with poor Bishop score, and the findings demonstrated a high overall efficacy rate of 84.70%, indicating that prostaglandin is an effective cervical ripening agent in this clinical scenario. The mean gestational age of 39.08±0.93 weeks in our study population represents the optimal timing for labor induction, as this period corresponds to fetal maturity while minimizing the risks associated with post-term pregnancy. The mean parity of 2.09±1.14 suggests that the study included a mixed population of both primiparous and multiparous women, which is clinically relevant since parity influences cervical responsiveness to prostaglandins due to previous cervical dilatation and tissue remodeling. The higher success rate observed in women aged >30 years (96.4%) compared to those aged ≤30 years (81.1%), though not statistically significant, may be attributed to increased myometrial sensitivity to prostaglandins with advancing maternal age and the cumulative effect of hormonal exposure over time. The lack of significant association between gestational age and efficacy suggests that prostaglandin effectiveness remains consistent near term, as the cervix becomes increasingly responsive to prostaglandins regardless of whether induction occurs at or slightly beyond 39 weeks.

The 100% success rate in women with parity >3, compared to 83.6% in those with parity ≤3, can be explained by the previously stretched and remodeled cervical tissue in multiparous women, which demonstrates enhanced responsiveness to prostaglandin-induced collagen breakdown and cervical softening. Women with higher BMI (>25 Kg/m²) showed better efficacy (91.8%) than those with BMI ≤25 Kg/m² (79.7%), which may be related to increased adipose tissue serving as a reservoir for prostaglandin synthesis and storage, potentially augmenting the exogenous prostaglandin effect. The trend toward higher success rates in women from higher socioeconomic status (100% in rich category) could be attributed to better nutritional status, reduced physical stress, and improved overall health conditions that optimize uterine responsiveness. Similarly, urban residents demonstrated higher efficacy (92.1%) compared to rural residents (81.3%), potentially reflecting better prenatal care, nutritional adequacy, and earlier access to healthcare facilities that contribute to favorable cervical conditions at the time of induction.

The overall efficacy of prostaglandin in labor induction observed in our study (84.70%) aligns closely with findings from multiple regional studies, demonstrating consistent success rates across different populations and settings. Raza & Majeed¹⁵ reported an 82% vaginal delivery rate using intracervical PGE2 gel in women with Bishop scores 1-4, while Gupta et al.¹⁶ documented success rates of 87.6% with single-dose and 84% with multiple-dose intravaginal PGE2 in women with Bishop scores 1-6, both remarkably similar to our findings. This consistency suggests that prostaglandin remains a reliable cervical ripening agent regardless of the specific formulation or route of administration when the Bishop score is unfavorable. Afridi et al.¹⁷ reported even higher vaginal delivery rates of 90.7% with combined Foley catheter plus PGE2 and 88.7% with PGE2 alone in women with mean Bishop score 4.6, slightly exceeding our success rate, which may be attributed to their use of combination methods that provide both mechanical and pharmacological cervical ripening. The 15.30% failure rate in our study is comparable to the cesarean section rates reported in similar populations, with Qazi et al.¹⁸ documenting cesarean rates of 24.1% for misoprostol and 12.1% for PGE2 gel, while Ilyas et al.¹⁹ found cesarean rates of 18% and 20% for misoprostol and PGE2 respectively in women with premature rupture of membranes. The higher cesarean rate in the misoprostol group of Qazi et al.¹⁸ compared to PGE2 may explain why our PGE2-focused approach achieved better success, as PGE2 appears to provide more controlled and predictable cervical ripening with fewer complications. Sher et al.²⁰ reported a lower vaginal delivery rate of 62.2% when using concurrent oxytocin with dinoprostone in women with very poor Bishop scores of 2-3, suggesting that extremely unfavorable cervical conditions may limit prostaglandin efficacy regardless of augmentation strategies. Our finding that parity >3 showed 100% success compared to 83.6% in parity ≤3 is consistent with the principle that multiparous women respond more favorably to induction, as supported by Qamar et al.²¹ who reported higher vaginal delivery rates in multiparous

women (92.8%) compared to primiparous women (86.1%). The lack of significant association between gestational age and efficacy in our study ($p=0.745$) mirrors the findings of Gupta et al.¹⁶ and Raza & Majeed¹⁵ who included women across a range of gestational ages from 36-42 weeks without noting significant differences in outcomes, indicating that prostaglandin effectiveness remains stable at term regardless of exact gestational timing. However, the trend toward higher success in older women (>30 years: 96.4% vs ≤ 30 years: 81.1%, $p=0.069$) in our study contrasts with typical obstetric literature that often associates advanced maternal age with increased intervention rates, though Michail et al.²² noted that combining Bishop score with additional parameters improves prediction, suggesting that age alone may not be the determining factor when cervical favorability is considered. The association between higher BMI and improved efficacy in our study (BMI >25 : 91.8% vs BMI ≤ 25 : 79.7%) has not been consistently reported in the reviewed literature, as most studies did not stratify results by BMI, representing a unique finding that warrants further investigation into the potential role of adipose tissue in prostaglandin metabolism and effectiveness. Our observation of higher success rates in urban residents (92.1%) compared to rural residents (81.3%, $p=0.173$) and in higher socioeconomic groups (rich: 100%, middle: 84.6%, poor: 80.8%) suggests the influence of non-pharmacological factors such as nutritional status, prenatal care quality, and overall health conditions on induction outcomes, factors that were not specifically addressed in most comparative studies. The systematic review by Michail et al.²² emphasized that Bishop scores <6 consistently indicate the need for cervical ripening and that prostaglandins are particularly effective when Bishop scores are $\leq 3-4$, supporting our study population selection and approach. Ilyas et al.¹⁹ and Qazi et al.¹⁸ both demonstrated that alternative agents like oral misoprostol can shorten induction-to-delivery intervals by approximately 5 hours compared to PGE2 gel, though without significantly improving vaginal delivery rates, suggesting that while speed of induction may vary between agents, ultimate efficacy remains comparable. The safety profile observed across all studies, including ours, consistently shows low rates of serious maternal and neonatal complications, with Raza & Majeed¹⁵ reporting

only 4% hyperstimulation and 2% postpartum hemorrhage, Gupta et al.¹⁶ noting no serious complications, and Agha et al.²³ documenting only 1% uterine rupture in VBAC cases, reinforcing prostaglandin's favorable risk-benefit profile. The lack of statistical significance in most demographic associations in our study (all $p>0.05$ except age at 0.069) suggests that when prostaglandin is used appropriately for poor Bishop scores, its effectiveness transcends individual patient characteristics, making it a broadly applicable intervention across diverse populations as demonstrated by the consistent success rates across Pakistani, Indian, and international studies reviewed.

The present study has several limitations that should be acknowledged when interpreting the findings. Firstly, this was a single-center study conducted at one institution, which may limit the generalizability of the results to other healthcare settings with different patient populations, resource availability, and clinical protocols. The relatively modest sample size of 118 patients may have reduced the statistical power to detect significant associations between demographic factors and prostaglandin efficacy, as evidenced by the borderline p -value for age ($p=0.069$) and non-significant findings for other variables. The study did not include a control group receiving alternative induction methods such as mechanical cervical ripening or other prostaglandin formulations, which would have allowed for direct comparison of efficacy rates.

CONCLUSION

Our study has concluded that prostaglandin is an effective and reliable method for induction of labor in patients with poor Bishop score, demonstrating high overall success rates in achieving vaginal delivery. The findings indicate that prostaglandin-induced labor induction yields favorable outcomes across diverse demographic profiles, with effectiveness transcending most patient characteristics including gestational age, parity, body mass index, socioeconomic status, and residential location.

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