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Association of maternal characteristics with induced vaginal deliveries and its outcome: a hospital-based study in Karnali Academy of Health Sciences, Nepal

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Abstract

Introduction: Induction of labor (IOL) is commonly practiced obstetric intervention aimed at initiating uterine contractions before spontaneous labor onset when continuation of pregnancy may pose maternal or fetal risks. Its outcomes vary by indication, maternal characteristics, cervical favorability, and resource availability. Limited data exist on IOL outcomes from remote regions of Nepal. The main objective of our study was to evaluate the indications, methods, and outcomes of IOL at Karnali Academy of Health Sciences (KAHS), Jumla, and to determine associations between gestational age, maternal characteristics, and labor outcomes.

Method: A retrospective observational study was conducted among all singleton, cephalic pregnancies ≥34 weeks undergoing IOL from January to December 2024. Data were extracted from labor registers and analyzed using SPSS 16. Descriptive statistics summarized demographic and clinical variables. Chi-square tests assessed associations between induction and gestational age, maternal age, and parity.

Result: Among 800 deliveries, 122 (15.3%) underwent induction. Most common indications were post-term pregnancy (28.8%) and late-term pregnancy (21.9%). Significant association was found between gestational age and method of labor onset ($p < 0.001$). Parity showed significant association when grouped into nulliparous vs multiparous ($p = 0.0037$). Maternal complications were low, with first- and second-degree perineal tears being most common. Postpartum hemorrhage occurred in only 0.48% of induced cases.

Conclusion: IOL practices at KAHS follow global guidelines and show good maternal outcomes. Induction was mainly for evidence-based reasons and linked to low maternal complications. Standardized protocols, better documentation, and ongoing labor monitoring could further improve outcomes in remote areas.

Keywords: High-altitude tertiary center; Induction of labor; Post-term pregnancy; Vaginal delivery

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INTRODUCTION

Labor induction is indicated in various obstetric conditions, such as post-term pregnancy, pre-eclampsia, premature rupture of membranes (PROM), fetal growth restriction, and medical conditions like gestational diabetes.[1] Despite its benefits in preventing prolonged pregnancy complications, induction of labor (IOL) is associated with increased risks of cesarean section, uterine hyperstimulation, fetal distress, and postpartum hemorrhage.[2] The American College of Obstetrics and Gynecology (ACOG) recommends offering routine induction or expectant management after 41+0 completed weeks.[3] According to the British guidelines, women with uncomplicated pregnancies should usually be offered induction of labor between 41+0 and 42+0 weeks to avoid the risks of prolonged pregnancy.[4] In Nepal, maternal and neonatal mortality remain a significant concern, especially in remote areas like the western Karnali region, where healthcare services are limited. Poor healthcare infrastructure, lack of skilled birth attendants, and delays in seeking care contribute to adverse maternal and neonatal outcomes.[5] Although a few studies showed no differences in maternal and fetal outcomes when IOL has been performed, expert opinions vary concerning this issue.[6,7] Understanding the impact of IOL in such settings is crucial to improving obstetric care and ensuring safer deliveries.[8] The progress of induced labor is one of the most important factors affecting overall maternal satisfaction.[9] Outpatient cervical ripening, sufficient patient information, and the active role of the woman improve the maternal experience.[10,11] Traditionally, observational studies have associated IOL with caesarean delivery (CD); however, emerging evidence challenges this association.[12]

Despite the increasing use of IOLs in Nepal, there is limited data on their outcomes in rural, resource-limited settings such as the Western Karnali region in Jumla district. Given the disparities in healthcare access, maternal health status, and fetal conditions, understanding the success rates and complications post-IOL in this region is essential. The study will contribute to evidence-based clinical decision-making and help optimize labor induction protocols, ultimately improving maternal and neonatal health outcomes. The study aimed to compare maternal characteristics and outcomes between spontaneous and induced vaginal deliveries and to evaluate the association of maternal age, gestational age, and parity with vaginal deliveries following induction.

METHOD

This study is a quantitative, hospital-based, observational, retrospective study. The study was conducted in the maternity ward of Karnali Academy of Health Sciences (KAHS), Jumla, for 1 year, from January to December 2024. The study population included all pregnant women admitted for deliveries at ≥34 weeks of gestation with a singleton pregnancy and cephalic presentation during the study period. Women were categorized into spontaneous labor and induction of labor groups based on the onset of labor for comparative analysis of induction practices and outcomes. Exclusion criteria were a history of previous cesarean section, malpresentation, contraindications to vaginal delivery, and severe pre-existing medical conditions (respiratory, cardiovascular, endocrine, renal, metabolic, autoimmune, hematological, and hepatic disorders) impacting outcomes. Convenience sampling was used, with all eligible deliveries included during the study period. Ethical approval was obtained from the Institutional Review Committee (IRC) of KAHS before initiating the study. Data were retrieved from maternity ward admission records, labor and delivery registers, and the induction protocol record book. The study variables were maternal age, parity, gestational age, indication for IOL, and maternal outcomes. Maternal outcomes assessed vaginal deliveries with episiotomy and complications such as episiotomy, first, second, third, and fourth-degree perineal tears. Incomplete or missing records were excluded from the study. Data were entered in Microsoft Excel, and statistical analyses were performed using SPSS version 16. Descriptive statistics were used to summarize maternal age, gestational age, parity, onset of labor, and mode of delivery. Maternal age was treated as a continuous variable and summarized using median and interquartile range (IQR), and was also categorized into clinically relevant age groups for comparative analysis. Gestational age and parity were analyzed as categorical variables and presented as frequencies and percentages. Frequencies and percentages were calculated for all categorical variables. The chi-square test was used to assess associations between categorical variables, including maternal age group, gestational age category, parity, and onset of labor (spontaneous versus induced), with vaginal delivery outcomes. Fisher's Exact Test was applied where expected cell counts were less than five. A p-value <0.05 was considered statistically significant.

RESULT

Among the 800 deliveries analyzed, 552 (69.0%) women had spontaneous onset of labor (including 37 with augmentation), while 154 (19.3%) underwent induction of labor (including 32 with augmentation). Vaginal delivery occurred in 477 women following spontaneous labor and in 122 women following induction. Cesarean section was required in 75 spontaneous labor cases and 32 induced labor cases. Additionally, 94 women underwent cesarean section without labor. Overall, 599 (74.9%) deliveries were vaginal and 201 (25.1%) were cesarean.

The median maternal age across all deliveries was 23 years (interquartile range [IQR]: 20–27), while the median maternal age among women who delivered vaginally was also 23 years (IQR: 20–26). Among vaginal deliveries, the most common age group was 21–25 years, followed by 16–20 years, in both spontaneous and induced labor groups.

There was no statistically significant association between maternal age and the occurrence of induced vaginal delivery (Table 1).

Table 1. Age-group-wise distribution of spontaneous and induced vaginal deliveries (n =599)

Age (years)	Spontaneous	Induced	
<16	2	0	
16-20	142	33	
21-25	209	49	χ^2= 7.403 (df=6)
26-30	83	30	p- value=0.285
31-35	35	6	
36-40	4	3	
>41	2	1	

Most spontaneous vaginal deliveries occurred between 37+1 and 39+6 weeks of gestation, whereas induced vaginal deliveries were more frequent at ≥40 weeks of gestation, particularly between 40+1 and 40+6 weeks (Table 2).

Table 2. Gestational age-wise distribution of spontaneous and induced vaginal deliveries (n=599)

Gestational age	Spontaneous	Induced	
<37	54	7	
37^{+1} – 39^{+6}	217	34	χ^2= 23.993 (df=4)
40^{+1}-40^{+6}	138	47	p- value=0.001
41^{+1}-41^{+6}	46	24	
>42	22	10	

The chi-square test demonstrated a statistically significant association between gestational age category and onset of labor, indicating that induction of labor was increasingly utilized with advancing gestational age (p = 0.001). Vaginal deliveries occurred in both primiparous and multiparous women, with spontaneous vaginal delivery being the predominant mode in both parity groups. There was no statistically significant association between parity and induction of labor among women who delivered vaginally (Table 3).

Table 3. Parity-wise distribution of spontaneous and induced vaginal deliveries (n = 599)

Parity	Spontaneous	induced	
P1	217	57	χ^2= 2.399 (df=5)
>P1	260	65	p- value=0.792

Table 4. Indications for induction

Indications	n (%)
Post term	42(28.8%)
Late term	32(21.9%)
PPROM	11(7.5%)
Teenage	11(7.5%)
Decreased fetal movement	10(6.8%)
Rh negative	10(6.8%)
Gestational HTN	9(6.2%)
Term	7(4.8%)
Elderly	4(2.7%)
Serology reactive	3(2.1%)
Oligohydramnios	3(2.1%)
IUFD	2(1.4%)
APH	1(0.7%)
Anencephaly	1(0.7%)

Table 5. Maternal outcome following induced vaginal deliveries (n=67)

Complications	n (%)
Episiotomy	15(11.1%)
1st degree tear	38(28.1%)
2nd degree tear	13(9.6%)
3rd degree tear	1(0.7%)

DISCUSSION

This study provides a comprehensive overview of labor onset patterns, induction practices, modes of delivery, and maternal outcomes following induced vaginal delivery in a remote tertiary care hospital in Nepal. Among the 800 deliveries analyzed, 552 women (69.0%) had spontaneous onset of labor, including 37 cases with augmentation, while 154 women (19.3%) underwent induction of labor, of whom 32 required augmentations. Vaginal delivery was achieved in 477 women following spontaneous labor and 122 women following induction, whereas cesarean section occurred in 75 spontaneous labor cases, 32 induced labor cases, and 94 cases without labor onset. Overall, 599 deliveries (74.9%) were vaginal, and 201 (25.1%) were cesarean. The induction of labor rate of 19.3% observed in this study is comparable with rates reported in other low- and middle-income countries and aligns with global practice patterns. Studies from India (12–18%), Pakistan (14–19%), and a multicountry analysis from Africa and Asia (10–22%) have reported similar induction frequencies, suggesting that induction practices in the present setting are consistent with regional and international norms. [14–16] The World Health Organization emphasizes that induction of labor, when appropriately indicated, is an effective intervention to improve perinatal outcomes without unnecessarily increasing operative delivery rates.[13]

Despite concerns that induction of labor may increase cesarean delivery, the majority of induced cases in the present study resulted in successful vaginal birth (122/154). This finding supports evidence from systematic reviews and large trials indicating that induction of labor does not inherently increase the risk of cesarean section when conducted using appropriate protocols and patient selection.[12,18] Wood et al., in their meta-analysis, demonstrated no significant increase in cesarean risk among women undergoing induction compared with expectant management, particularly in term and post-term pregnancies.[12]

The median maternal age in the study population was 23 years (IQR: 20–27), reflecting the relatively young obstetric population typical of South Asian settings. Among vaginal deliveries, the most common age group was 21–25 years, followed by 16–20 years, in both spontaneous and induced labor groups. No statistically significant association was observed between maternal age category and onset of labor, suggesting that age alone did not influence the likelihood of induction in this cohort. Similar findings have

been reported in other studies, in which induction decisions were driven more by obstetric indications than by maternal age alone.[20]

A significant association was observed between gestational age and the onset of labor, with induction rates increasing with advancing gestational age (p=0.001). Most spontaneous vaginal deliveries occurred between 37+1 and 39+6 weeks, whereas induced vaginal deliveries were more common at ≥40 weeks, particularly between 40+1 and 40+6 weeks. This pattern is consistent with WHO recommendations and international evidence supporting induction for post-term and late-term pregnancies to reduce perinatal morbidity and mortality.[13,17] Kortekaas et al. demonstrated improved perinatal outcomes with induction compared to expectant management in post-term pregnancies, without an increase in adverse maternal outcomes.[17]

The majority of women who delivered vaginally were primiparous, both in spontaneous and induced labor groups. However, no statistically significant association was found between parity and the onset of labor. This finding aligns with previous studies reporting that while parity influences labor duration and success, it does not independently dictate the need for induction when clinical indications are appropriately addressed.[19,21]

In the present study, the most common indication for induction was post-term pregnancy (28.8%), followed by late-term pregnancy (21.9%), prelabor rupture of membranes, teenage pregnancy, decreased fetal movements, and Rh-negative status. These indications are consistent with reports from tertiary hospitals in South Asia, where post-dated pregnancy remains the leading reason for induction.[14,15] Multicountry data from Vogel et al. similarly identified post-term pregnancy as a dominant indication across diverse low-resource settings.[16]

Maternal morbidity following induced vaginal delivery was predominantly minor. The most frequently observed outcomes were first-degree perineal tears (28.1%) and episiotomy (11.1%), with second-degree tears (9.6%) being less common. Only one case (0.7%) of third-degree perineal tear was recorded. These findings are comparable to published literature and suggest that induction of labor, when carefully managed, does not substantially increase severe perineal trauma.[22] The low incidence of severe maternal complications further supports the safety of induction practices in this setting.

The strengths of this study include a relatively large sample size, inclusion of all delivery modes, and detailed stratification of labor onset and outcomes. However, the retrospective design limits causal inference, and neonatal outcomes were not analyzed in detail. Additionally, the study relies on data from a single tertiary center, which may limit its generalizability to primary or private healthcare settings.

Despite these limitations, the findings provide valuable insight into labor induction practices in a resource-limited, referral-based hospital and support the judicious use of induction in line with international guidelines. Future prospective studies incorporating neonatal outcomes and long-term maternal morbidity would further strengthen the evidence base.

CONCLUSION

Induction of labor at KAHS is practiced safely and appropriately, primarily for evidence-based indications such as late-term and post-term pregnancy. The significant association between gestational age and method of labor onset reflects sound clinical decision-making. Maternal outcomes were favorable, with low rates of postpartum hemorrhage and acceptable rates of perineal trauma. Although documentation gaps limited evaluation of cervical status and neonatal outcomes, the overall findings indicate that IOL is a reliable and beneficial intervention at KAHS. Strengthening protocol adherence, improving clinical documentation, and enhancing labor monitoring may further optimize maternal and neonatal safety in this remote region.

DECLARATIONS

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Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this article.

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Ethical approval

Ethical Approval was obtained from the IRC-KAHS (Ref: 2025/062).

Consent of Study

This was a retrospective, record-based study conducted using routinely collected hospital data. As the study involved no direct patient contact and no intervention, and all data were anonymized before analysis, the IRC of KAHS waived the requirement for individual informed consent.

Consent of Publication

Consent to publish was obtained from all authors, and all authors have reviewed and approved the final version of the manuscript for publication.

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