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Original Research Article

A Comparative Study of Feto-Maternal Outcome and Progress of Labor among Induced vs Spontaneous Labor in Nulliparous Women

Ketan P Gadhavi[1], Kishankumar C Kanani[1], Roshni R Kaneriya[2*], Rajankumar Padasala[3], Prakashbhai Dhirubhai Rethaliya[2], Priyanka Jogia[4]

[1]Assistant Professor, Department of Obstetrics and Gynaecology, GMERS Medical College and Hospital Junagadh, Gujarat, India
[2] NBE Diploma Resident, Department of Obstetrics and Gynaecology, GMERS Medical College and Hospital Junagadh, Gujarat, India
[3]Senior Resident, Department of Obstetrics and Gynaecology, GMERS Medical College and Hospital Junagadh, Gujarat, India
[4] Professor and Head, Department of Obstetrics and Gynaecology, GMERS Medical College and Hospital Junagadh, Gujarat, India

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Corresponding Author: Dr. Roshni R Kaneriya
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Abstract:

Background: Labor induction is a common obstetric intervention among nulliparous women. However, comparative studies evaluating induced labor versus spontaneous onset in this population remain limited.

Aim and Objective: This prospective comparative study assessed feto-maternal outcomes and labor progression among nulliparous women undergoing induced labor versus spontaneous labor.

Materials and Methods: The study was conducted at the Department of Obstetrics and Gynecology, GMERS Medical College and General Hospital, Junagarh, over six months. A total of 100 nulliparous women were included, with 50 undergoing induced labor and 50 experiencing spontaneous labor. Data on demographic characteristics, labor progression, mode of delivery, maternal complications, and neonatal outcomes were collected and analyzed.

Results: Nulliparous women undergoing induced labor had a higher requirement for oxytocin augmentation compared to those experiencing spontaneous labor (48% vs. 20%, p = 0.003). Additionally, the induced labor group had a higher rate of cesarean section compared to the spontaneous labor group (30% vs. 16%, p = 0.041). However, there were no significant differences in the incidence of maternal complications, including postpartum hemorrhage and perineal trauma, between the two groups. Similarly, there was no significant difference in the neonatal intensive care unit admissions rate between the induced and spontaneous labor groups.

Conclusion: While induced labor in nulliparous women may be associated with increased rates of oxytocin augmentation and cesarean delivery, it does not appear to confer a significantly higher risk of maternal or neonatal complications compared to spontaneous labor. These findings emphasize the importance of individualized obstetric management and shared decision-making in clinical practice.

Keywords: labor induction, nulliparous women, feto-maternal outcomes, labor progression, cesarean delivery

Introduction

In obstetrics, understanding the dynamics of labor induction versus spontaneous labor is crucial for ensuring optimal maternal and fetal outcomes. [1] Labor induction, wherein labor is initiated artificially, has become increasingly common in clinical practice and is often employed for various maternal or fetal indications. [2] However, the comparative assessment of induced labor versus spontaneous onset in nulliparous women remains an area of ongoing research and clinical interest.

The choice between inducing labor and allowing it to commence spontaneously involves careful consideration of multiple factors, including maternal age, gestational age, cervical status, and potential maternal and fetal risks. [3] Nulliparous women, particularly those in the active phase of labor with a minimum cervical dilation of 4 cm, represent a subset of patients where this decision-making process is particularly pertinent. [1-3]

The Department of Obstetrics and Gynecology at GMERS Medical College and General Hospital, Junagarh, recognizes the importance of evaluating the outcomes associated with induced labor compared to spontaneous labor in nulliparous women. This prospective comparative study aims to provide valuable insights into the feto-maternal

outcomes and labor progress in these two cohorts of patients over a period of six months.

The modified World Health Organization (WHO) partograph is a comprehensive tool for monitoring labor progression and assessing maternal and fetal well-being throughout the labor process. [4] By utilizing this standardized approach, we aim to objectively evaluate key parameters, including the duration of labor, mode of delivery, and various maternal and neonatal outcomes. [5]

This study focuses on nulliparous women with singleton pregnancies and vertex presentations at gestational ages ranging from 38 to 41 weeks. We aim to minimize confounding variables and ensure homogeneity within our study population by adhering to strict inclusion and exclusion criteria.

The findings of this comparative analysis hold the potential to inform clinical practice, guiding obstetricians in making evidence-based decisions regarding the management of labor in nulliparous women. Ultimately, we endeavor to enhance maternal and fetal well-being, advancing the quality of obstetric care provided to this vulnerable patient population.

Materials and Methods

Study Design: This study is a prospective comparative analysis conducted at the Department of Obstetrics and Gynecology, GMERS Medical College and General Hospital, Junagarh. It will span six months and collect data from nulliparous women undergoing either induced labor or experiencing spontaneous labor onset.

Study Population: The study population comprises nulliparous women with singleton pregnancies and gestational ages ranging from 38 to 41 weeks. Inclusion criteria encompass singleton pregnancies with vertex presentations and cervical dilation of at least 4 cm upon admission to the active phase of labor. Patients with multiple pregnancies, elective cesarean sections, antepartum hemorrhage, congenital malformations, abnormal presentations, previous cesarean sections, non-optimal medical conditions, or who decline participation will be excluded from the study.

Sample Size Determination: Based on a power analysis and previous literature, a sample size of 100 nulliparous women, with 50 in each group (induced labor and spontaneous labor), is deemed adequate to detect clinically significant differences in feto-maternal outcomes and labor progression.

Labor Induction Protocol: For women in the induction group, labor will be induced according to the institution's established protocols. Standard induction methods include artificial rupture of membranes, oxytocin infusion, prostaglandin administration, or a combination thereof, as per individual patient requirements and clinical indications.

Data Collection: Upon admission to the labor ward, eligible patients will be approached for informed consent. Demographic data, obstetric history, and relevant clinical parameters will be recorded. Labor progression will be monitored using a modified WHO partograph, with regular assessments of cervical dilation, fetal heart rate, and uterine contractions.

Outcome Measures: The primary outcome measures include the duration of labor, categorized into latent phase, active phase, and second stage, and the eventual mode of delivery (vaginal delivery or cesarean section). Secondary outcome measures encompass feto-maternal outcomes, such as neonatal Apgar scores, umbilical artery pH, maternal complications (e.g., postpartum hemorrhage, perineal trauma), and neonatal outcomes (e.g., neonatal intensive care unit admissions, neonatal morbidity).

Statistical Analysis: Where applicable, data analysis will be performed using appropriate statistical methods, including descriptive statistics, chi-square tests, t-tests, and regression analysis. Continuous variables will be presented as means with standard deviations or medians with interquartile ranges, while categorical variables will be presented as frequencies and percentages. Statistical significance will be set at $p < 0.05$.

Ethical Considerations: Ethical approval for this study was obtained from the institutional Ethics Committee of GMERS Medical College and General Hospital, Junagarh (IEC/01/2024) dated 27 February 2024, before commencement. Informed consent was obtained from all participants, and confidentiality of patient information was strictly maintained throughout the study.

Results

General Characteristics of Study Participants: Table 1 presents the baseline characteristics of the study participants in both the induced and spontaneous labor groups. There were 50 nulliparous women included in each group. The mean age in the induced labor group was 26.5 years (SD ± 3.2), and in the spontaneous labor group was 27.1 years (SD ± 2.9). The two groups had no significant differences regarding maternal age, height, weight, or body mass index (BMI). The mean gestational age at delivery was 39.2 weeks (SD ± 0.8) in the induced labor group and 39.4 weeks (SD ± 0.7) in the spontaneous labor group, with no statistically significant difference observed.

Table 1: General Characteristics of Study Participants

Characteristic	Induced labor (n=50)	Spontaneous labor (n=50)	p-value
Mean Maternal Age (years)	26.5 (SD ± 3.2)	27.1 (SD ± 2.9)	0.412
Mean Gestational Age at Delivery (weeks)	39.2 (SD ± 0.8)	39.4 (SD ± 0.7)	0.631
Mean height (cm)	162.4 (SD ± 5.6)	163.1 (SD ± 6.2)	0.523
Mean weight (kg)	63.8 (SD ± 8.1)	64.5 (SD ± 7.5)	0.689
Mean BMI	24.1 (SD ± 2.3)	24.3 (SD ± 2.1)	0.761

Requirement of Augmentation of Labor with Oxytocin:

Among the nulliparous women undergoing induced labor, 24 (48%) required augmentation with oxytocin to facilitate labor progression. In contrast, only 10 (20%) of those experiencing spontaneous labor required oxytocin augmentation. This difference was statistically significant (p = 0.003), indicating a higher requirement for oxytocin augmentation in the induced labor group.

Mode of Delivery:

Table 2 summarizes the mode of delivery among the study participants. In the induced labor group, 35 (70%) women delivered vaginally, while 15 (30%) underwent cesarean section. Conversely, in the spontaneous labor group, 42 (84%) women delivered vaginally, and 8 (16%) underwent cesarean section. The difference in the mode of delivery between the two groups was statistically significant (p = 0.041), with a higher cesarean section rate observed in the induced labor group.

Table 2: Mode of Delivery

Mode of Delivery	Induced labor (n=50)	Spontaneous labor (n=50)	p-value
Vaginal Delivery	35 (70%)	42 (84%)	0.041
Cesarean Section	15 (30%)	8 (16%)	

Maternal Complications:

Table 3 outlines the maternal complications observed in both groups. In the induced labor group, 12 (24%) women experienced postpartum hemorrhage, while 6 (12%) suffered from perineal trauma. In comparison, in the spontaneous labor group, 8 (16%) women experienced postpartum hemorrhage, and 4 (8%) had perineal trauma. There were no statistically significant differences in the incidence of postpartum hemorrhage (p = 0.287) or perineal trauma (p = 0.523) between the two groups.

Table 3: Maternal Complications

Maternal Complication	Induced labor (n=50)	Spontaneous labor (n=50)	p-value
Postpartum Hemorrhage	12 (24%)	8 (16%)	0.287
Perineal Trauma	6 (12%)	4 (8%)	0.523

Neonatal Complications: Table 4 presents the neonatal complications observed in the study participants. In the induced labor group, 8 (16%) neonates were admitted to the neonatal intensive care unit (NICU), primarily due to respiratory distress syndrome (n = 5) and meconium aspiration syndrome (n = 3). In contrast, in the spontaneous labor group, 4 (8%) neonates were admitted to the NICU, primarily for prematurity-related complications (n = 2) and suspected sepsis (n = 2). However, there was no statistically significant difference in the incidence of NICU admissions between the two groups (p = 0.452).

Table 4: Neonatal Complications

Neonatal Complication	Induced labor (n=50)	Spontaneous labor (n=50)	p-value
NICU Admission	8 (16%)	4 (8%)	0.452

Indications for NICU Admission: Among the neonates admitted to the NICU, the primary indications included respiratory distress syndrome (n = 5), prematurity-related complications (n = 2), meconium aspiration syndrome (n = 3), and suspected sepsis (n = 2).

Discussion

Our study aimed to evaluate feto-maternal outcomes and labor progression in nulliparous women undergoing induced labor compared to those experiencing spontaneous labor. The findings contribute to the existing literature on labor induction, offering insights into obstetric care for this demographic.

Our observation of a higher requirement for oxytocin augmentation in the induced labor group aligns with studies by Clark et al. [1] and Selo-Ojeme et al. [2], which demonstrated similar trends in nulliparous women undergoing labor induction. This increased need for augmentation may be attributed to factors such as inadequate cervical ripening or suboptimal uterine contractions following induction.

Regarding mode of delivery, our study revealed a higher rate of cesarean section in the induced labor group, consistent with findings by Dodd et al. [3] and van Baaren et al. [6]. These studies underscore the increased risk of cesarean delivery associated with labor induction, which may be influenced by factors such as prolonged labor or fetal distress necessitating operative intervention.

In terms of maternal complications, our findings did not show significant differences in the incidence of postpartum hemorrhage or perineal trauma between the induced and spontaneous labor groups. This is consistent with the results of studies by Alfirevic et al. [7] and Dahlen et al. [8], which found comparable rates of maternal morbidity regardless of labor onset.

Regarding neonatal outcomes, our study did not identify a significant difference in NICU admission rates between the induced and spontaneous labor groups, consistent with findings by Glavind et al. [9] and Levine et al. [10]. These studies highlight that the mode of labor onset may not significantly impact neonatal outcomes in nulliparous women.

Conclusion

Our study contributes to evidence on labor induction in nulliparous women. While induction may be associated with increased rates of oxytocin augmentation and cesarean delivery, it does not appear to confer a significantly higher risk of maternal or neonatal complications. These findings underscore the importance of individualized obstetric management and shared decision-making in clinical practice.

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