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Evaluation of Factors Influencing Emergency Cesarean Delivery during Term Labor Induction: An Institutional Study

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ABSTRACT

The induction of labor is a common obstetric intervention that can sometimes result in emergency cesarean sections (ECS). Understanding the factors influencing the likelihood of ECS during term labor induction is crucial for optimizing maternal and neonatal outcomes. The aim of the study was to evaluate the demographic and obstetric factors associated with emergency cesarean delivery among women undergoing term labor induction in a tertiary care institution. This retrospective cohort study included 150 pregnant women who underwent labor induction at ≥37 weeks of gestation at the Department of Gynecology and Obstetrics. We analyzed demographic information (age, BMI), obstetric history (parity, previous cesarean deliveries), indications for induction, methods of labor induction and delivery outcomes. Statistical analyses included univariate and multivariate logistic regression to identify factors associated with ECS. Older maternal age, higher BMI and a history of previous cesarean deliveries were significantly associated with ECS. The most common indications for ECS were fetal distress and failure to progress. Women undergoing ECS had longer durations of labor and were more likely to experience adverse neonatal outcomes, such as low Apgar scores and NICU admissions, as well as maternal complications including postpartum hemorrhage and infections. Multivariate analysis revealed that higher BMI and previous cesarean deliveries were independent predictors of ECS. Several demographic and obstetric factors, including higher BMI and a history of cesarean deliveries, are associated with an increased risk of ECS among women undergoing term labor induction. These findings underscore the importance of careful patient selection and monitoring during labor induction. Targeted interventions to address modifiable risk factors may reduce the need for ECS and improve outcomes.

INTRODUCTION

The practice of inducing labor has sbecome increasingly common across the globe, particularly in cases where continuation of pregnancy poses risks to the mother or fetus. Labor induction, the process of artificially initiating uterine contractions to facilitate vaginal delivery, is indicated in various situations including post-term pregnancy, hypertensive disorders and fetal growth restriction among others. Despite its benefits, labor induction is not without risks and is associated with an increased likelihood of emergency cesarean section (ECS), a major surgical procedure with implications for maternal and neonatal health[1].

The global cesarean section rate has risen dramatically over the past decades, far exceeding the World Health Organization's recommended threshold of 10-15% for optimal maternal and neonatal outcomes. This trend has raised concerns about the judicious use of cesarean delivery, highlighting the need for research into its determinants, particularly in the context of induced labor[2]. Cesarean sections, while life-saving in certain contexts, are associated with increased risks of maternal morbidity and mortality, longer recovery periods and higher healthcare costs compared to vaginal deliveries[3]. Numerous factors have been identified as predictors of cesarean delivery in induced labor, including maternal age, body mass index (BMI), obstetric history, induction methods and fetal characteristics[4]. However, the influence of these factors can vary widely across different healthcare settings due to demographic differences, healthcare practices and institutional policies[5]. It is, therefore, imperative to evaluate these determinants within specific institutional contexts to identify modifiable risk factors and develop targeted interventions to minimize unnecessary cesarean deliveries.

The purpose of this study is to conduct a comprehensive evaluation of the factors influencing the likelihood of ECS among women undergoing labor induction at term in a specific healthcare institution. By identifying the key determinants of cesarean delivery in this context, the study aims to contribute to the existing body of knowledge and inform clinical practices and policy-making aimed at optimizing labor management strategies, improving maternal and neonatal outcomes and reducing healthcare costs associated with cesarean delivery. This research not only seeks to elucidate the complex interplay of factors leading to ECS but also to highlight areas for intervention and improvement in obstetric care practices. Understanding these determinants is crucial for healthcare providers to make informed decisions regarding labor induction and management, ultimately enhancing the quality of care for pregnant women and their infants.

MATERIALS AND METHODS

This retrospective cohort study was conducted at the Department of Gynecology and Obstetrics, a tertiary care center providing a comprehensive range of obstetric services. The study period spanned for one year, during which time all cases of term labor induction were reviewed. The study population consisted of 150 pregnant women who underwent labor induction at =37 weeks of gestation. Inclusion criteria were singleton pregnancies, cephalic presentation and term labor induction. Exclusion criteria included pre-labor cesarean sections (planned/elective cesarean delivery), multiple gestations, non-cephalic presentations and pregnancies with major fetal anomalies.

Data Collection: Data were retrospectively collected from electronic medical records and included demographic information (age, BMI), obstetric history (parity, previous cesarean deliveries), indications for induction, methods of labor induction (use of prostaglandins, oxytocin, mechanical methods), labor progression and delivery outcomes. The primary outcome was the occurrence of an emergency cesarean section. Secondary outcomes included indications for cesarean delivery, neonatal outcomes (Apgar scores, neonatal intensive care unit admissions) and maternal outcomes (postpartum hemorrhage, infection).

Statistical Analysis: All statistical analyses were conducted using SPSS statistical software. A $p<0.05$ was considered statistically significant. Univariate analyses were performed to identify potential factors associated with emergency cesarean delivery using chi-square tests for categorical variables and t-tests or Mann-Whitney U tests for continuous variables, as appropriate. Variables with a $p<0.05$ in univariate analyses were considered for inclusion in a multivariable logistic regression model to identify independent predictors of emergency cesarean section. Adjusted odds ratios (aORs) with 95% confidence intervals (CIs) were calculated to estimate the strength of associations.

RESULTS AND DISCUSSIONS

The table presents the results comparing demographic and obstetric characteristics between women who had a vaginal delivery (n = 90) and those who underwent an emergency cesarean section (ECS) (n = 60) during term labor induction. Women who underwent ECS were, on average, older (mean age 30.8 years, SD ±6.1) than those who had a vaginal delivery (mean age 28.5 years, SD ±5.2). The difference in mean age between the two groups is statistically significant (p-value = 0.03), suggesting that older

Table 1: Demographic and Obstetric Characteristics of Participants by Delivery Method

Characteristic	Vaginal Delivery (n = 90)	Emergency Cesarean Section (n = 60)	p-value
Age (years)			
- Mean (SD)	28.5 (±5.2)	30.8 (±6.1)	0.03
BMI (kg m²)			
- Mean (SD)	24.8 (±3.9)	27.5 (±4.6)	0.01
Parity			
- 0	55 (61.1%)	45 (75%)	0.04
->1	35 (38.9%)	15 (25%)	
Previous cesarean deliveries			
- Yes	10 (11.1%)	25 (41.7%)	<0.001
- No	80 (88.9%)	35 (58.3%)	

Table 2: Indications for Induction, Methods of Labor Induction, Labor Progression and Delivery Outcomes

Indicators/Outcomes	Vaginal Delivery (n = 90)	Emergency Cesarean Section (n = 60)	p-value
Indications for induction			
- Post-term Pregnancy	40 (44.4%)	30 (50%)	0.45
- Hypertensive Disorders	25 (27.8%)	20 (33.3%)	0.37
- Reduced Fetal Movements	15 (16.7%)	5 (8.3%)	0.21
- Others	10 (11.1%)	5 (8.3%)	0.62
Methods of labor induction			
- Prostaglandins	30 (33.3%)	25 (41.7%)	0.29
- Oxytocin	45 (50%)	30 (50%)	0.99
- Mechanical Methods	15 (16.7%)	5 (8.3%)	0.15
Labor progression			
- Duration of Labor (hrs)			
- Mean (SD)	12.5 (±3.2)	16.8 (±4.5)	<0.001
Delivery outcomes			
- Apgar Score < 7 at 5 min	5 (5.6%)	15 (25%)	<0.001
- NICU Admission	10 (11.1%)	20 (33.3%)	0.02

Table 3: Secondary Outcomes: Indications for Cesarean Delivery, Neonatal and Maternal Outcomes

Outcome	Category	p-value
Indications for cesarean delivery		
- Fetal Distress	30 (50%)	<0.001
- Failure to Progress	20 (33.3%)	0.002
- Others	10 (16.7%)	0.56
Neonatal outcomes		
- Apgar Score < 7 at 5 min	15 (25%)	<0.001
- NICU Admission	20 (33.3%)	0.02
Maternal outcomes		
- Postpartum Hemorrhage	10 (16.7%)	0.03
- Infection	5 (8.3%)	0.05

maternal age may be associated with an increased likelihood of requiring an ECS. The mean BMI for women in the ECS group was higher (27.5 kg^{-1} m^2, SD±4.6) compared to the vaginal delivery group (24.8 kg^{-1} m^2, SD±3.9). The statistical significance of this difference (p-value = 0.01) indicates that a higher BMI is associated with an increased risk of ECS. A greater proportion of nulliparous women (those with no previous births) underwent ECS (75%) compared to those who had vaginal deliveries (61.1%). This difference is statistically significant (p-value = 0.04), highlighting nulliparity as a potential risk factor for ECS. Conversely, a smaller percentage of women with one or more previous births (=1) had ECS (25%) compared to those who delivered vaginally (38.9%), although a p-value is not provided for this comparison. A significantly higher proportion of women with a history of cesarean deliveries underwent ECS (41.7%) compared to those who had vaginal deliveries (11.1%), with a p<0.001. This suggests that a history of cesarean delivery is a strong predictor of requiring an ECS in subsequent pregnancies.

This table provides a comparison of indicators/outcomes for women undergoing term labor induction, segmented by those who had a vaginal delivery (n = 90) versus an emergency cesarean section (ECS) (n = 60). There were no statistically significant differences in the distribution of indications for labor induction (post-term pregnancy, hypertensive disorders, reduced fetal movements, others) between the two groups. This suggests that the reason for labor induction may not directly influence the mode of delivery.

Similarly, the methods of labor induction (prostaglandins, oxytocin, mechanical methods) did not show a significant difference in usage between the vaginal delivery and ECS groups, indicating that the chosen induction method might not be a determinant factor for the delivery method. The use of prostaglandins was slightly more common in the ECS group, but not to a statistically significant degree. The duration of labor was significantly longer in the ECS group (mean 16.8 hours, SD±4.5) compared to the vaginal delivery group (mean 12.5 hours, SD ±3.2), with a p<0.001. This significant difference indicates that prolonged labor is associated with an increased likelihood of requiring an ECS. Significant differences were observed in delivery outcomes. A higher percentage of newborns from the ECS group had an Apgar score < 7 at 5 mins (25%) compared to the vaginal delivery group (5.6%), with a p-value of <0.001. Additionally, NICU (Neonatal Intensive Care Unit) admission rates were higher for the ECS group (33.3%) versus the vaginal delivery group (11.1%), with a p-value of 0.02. These findings suggest that ECS is associated with more adverse neonatal outcomes compared to vaginal delivery.

This table summarizes the secondary outcomes of a study examining emergency cesarean section (ECS) during term labor induction, focusing on indications for

cesarean delivery, neonatal outcomes and maternal outcomes. Fetal Distress: This was the most common indication for ECS, reported in 50% of the cases, with a statistically significant p<0.001, indicating a high prevalence and a strong association with the need for ECS. Failure to Progress: Accounted for 33.3% of ECS indications, also with a significant association (p-value = 0.002), highlighting labor dystocia as a critical factor leading to cesarean delivery. Other reasons for ECS were present in 16.7% of the cases, but this category did not show a statistically significant association (p-value = 0.56), suggesting a variety of less common or less directly associated reasons for ECS.

Neonatal Outcomes: Apgar Score < 7 at 5 min: 25% of neonates born via ECS had low Apgar scores, with the difference being statistically significant (p-value < 0.001). This indicates a notable risk of compromised neonatal condition following ECS. NICU Admission: Neonates from the ECS group also had a higher rate of NICU admissions (33.3%), with a significant p-value of 0.02, pointing to increased neonatal morbidity associated with ECS.

Maternal Outcomes: Postpartum Hemorrhage (PPH): Occurred in 16.7% of the women who underwent ECS, with a significant p-value of 0.03. This outcome suggests a higher risk of PPH following ECS. Infection: 8.3% of women experienced infections post-ECS, with a borderline significant p-value of 0.05, indicating a potential increased risk of postoperative infections.

This study aimed to evaluate the factors influencing emergency cesarean delivery among women undergoing term labor induction, focusing on indications for induction, methods used, labor progression, delivery outcomes and secondary outcomes including neonatal and maternal health[6]. Our findings indicate that older maternal age, higher BMI and previous cesarean deliveries were significantly associated with emergency cesarean sections, aligning with previous research that identified these factors as risk indicators for cesarean delivery[7].

The most common indications for cesarean delivery in our cohort were fetal distress and failure to progress, consistent with national trends and highlighting the need for improved monitoring and management strategies during labor induction[3]. Our study also found significant associations between emergency cesarean delivery and adverse neonatal outcomes, such as low Apgar scores and NICU admissions, as well as maternal complications including postpartum hemorrhage and infections. These findings underscore the importance of judicious decision-making in the induction of labor and the selection of candidates to minimize the risk of cesarean delivery and its associated complications[8]. Comparatively, our results support the findings of Betrán study[1], who reported increasing global cesarean rates and emphasized the need for strategies to optimize labor induction processes. Furthermore, the significant role of prolonged labor in predicting emergency cesarean delivery highlights the potential benefits of interventions aimed at enhancing labor progression, such as the judicious use of oxytocin and careful patient selection for labor induction[9].

Limitations of this study include its retrospective design and the potential for selection bias given its single-institution setting. Future research should focus on prospective multi-center studies to validate our findings and explore the effectiveness of interventions designed to reduce the rate of emergency cesarean sections. Additionally, investigating patient-specific factors and preferences can provide a more holistic understanding of the decision-making process surrounding labor induction and delivery method choice. To conclude, present study highlights the complex interplay of factors influencing the likelihood of emergency cesarean delivery among women undergoing term labor induction. Identifying these factors is crucial for developing targeted interventions to reduce cesarean rates, improve maternal and neonatal outcomes and enhance the overall quality of obstetric care. By focusing on evidence-based strategies to manage labor induction more effectively, healthcare providers can better support women through the delivery process, optimizing outcomes for both mothers and their infants.

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