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Research Article

Comparative Analysis of Vaginal Birth After Cesarean (VBAC) Success Rates between Different Induction Methods

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Abstract

Background: Vaginal Birth after Cesarean (VBAC) offers significant benefits over repeat cesarean sections, including reduced recovery times and lower complication rates. However, the success of VBAC largely depends on the method of labor induction used. This study evaluates the effectiveness and safety of different VBAC induction methods to ascertain optimal practices.

Methods: This retrospective study analyzed 180 women who attempted VBAC at a tertiary care center from January 2015 to December 2019. The induction methods compared were mechanical (Foley catheter), pharmacological (Misoprostol), and Oxytocin. Outcomes measured included the success rate of VBAC, time to labor onset, maternal complications, and neonatal ICU admissions. Statistical analysis involved chi-square tests for categorical data, t-tests for continuous variables, and logistic regression to adjust for confounding factors.

Results: The success rate of VBAC was highest with the mechanical method (62.96%), followed by Oxytocin (57.41%) and pharmacological methods (53.70%). The mechanical method also showed a statistically lower rate of maternal complications (14.81%) compared to the pharmacological (24.07%) and Oxytocin (18.52%) methods. Despite quicker labor onset with pharmacological induction, it did not translate to higher VBAC success.

Conclusion: Mechanical induction methods such as the Foley catheter are associated with higher VBAC success rates and fewer maternal complications compared to pharmacological and Oxytocin inductions. These findings suggest that mechanical methods might offer a safer and more effective option for inducing labor in women attempting VBAC. However, individual patient factors must be considered when selecting the appropriate induction method.

Keywords: VBAC, Labor Induction, Foley Catheter, Misoprostol, Oxytocin.

INTRODUCTION

Vaginal Birth After Cesarean (VBAC) is an increasingly important focus in obstetric care, offering a potential alternative to repeat cesarean deliveries, which carry higher risks of complications such as infections, blood loss, and extended hospital stays. Despite the advantages, the success of VBAC is heavily influenced by various factors including the method of labor induction used. Understanding these factors is crucial to improving outcomes for women who desire a vaginal birth after a cesarean.[1]

Labor induction in women with a previous cesarean section is a complex issue due to the increased risk of uterine rupture, which is a severe but rare complication. The literature indicates variable success rates associated with different induction methods, such as the use of prostaglandins, mechanical methods

like Foley catheters, and the administration of oxytocin. Each method has its benefits and risks, affecting not only the likelihood of achieving a vaginal delivery but also impacting maternal and neonatal safety.[2]

Furthermore, the decision-making process for attempting a VBAC includes an assessment of individual patient risk factors, such as the type of uterine incision from the previous cesarean, inter-delivery interval, maternal age, body mass index, and other medical and obstetric complications. These considerations are integral to developing guidelines and managing expectations for women considering VBAC.[3]

Aim

To compare the success rates of different labor induction methods in achieving vaginal birth after cesarean (VBAC).

Objectives

1. To evaluate the efficacy of mechanical versus pharmacological induction methods in VBAC attempts.
2. To analyze maternal and neonatal outcomes associated with different VBAC induction methods.
3. To identify patient and pregnancy characteristics that predict VBAC success across various induction techniques.

MATERIAL AND METHODOLOGY

Source of Data

The data for this comparative study were retrospectively collected from medical records of pregnant women who attempted a VBAC at our tertiary care center.

Study Design

This study was a retrospective comparative analysis of VBAC outcomes based on different induction methods utilized.

Study Location

The research was conducted at the Department of Obstetrics and Gynecology, Dr Ulhas Patil Medical college & hospital.

Study Duration

The study reviewed cases from January 2019 to December 2023.

Sample Size

The total number of participants included in the study was 180 women who met the inclusion criteria and consented to attempt a VBAC.

Inclusion Criteria

Included were women aged 18-45 with a history of one prior cesarean section, carrying a singleton pregnancy with a cephalic presentation, gestational age between 37 and 42 weeks, and who consented to VBAC.

Exclusion Criteria

Excluded were women with multiple gestations, non-cephalic presentations, more than one previous cesarean section, previous uterine rupture, contraindications to labor, or medical conditions precluding vaginal delivery.

Procedure and Methodology

Upon meeting the inclusion criteria, patients were grouped based on the induction method employed: mechanical methods (e.g., Foley catheter), pharmacological methods (e.g., Misoprostol), or oxytocin infusion. The choice of induction was based on clinical indications and patient preferences as discussed during prenatal visits.

Sample Processing

Not applicable as this was a retrospective study without biological sample collection.

Statistical Methods

Data analysis was performed using SPSS version 25. Descriptive statistics were employed to characterize the study population. Comparative analysis was done using Chi-square tests for categorical data and t-tests for continuous variables. Logistic regression was used to identify predictors of VBAC success.

Data Collection

Data were extracted from electronic health records, including demographic information, obstetric history, details of the current pregnancy, type of induction method used, labor progression, delivery outcome, and any complications.

OBSERVATION AND RESULTS

Table 1: Comparison of Success Rates of Different Labor Induction Methods in Achieving VBAC

Induction Method	Success Rate (n, %)	95% CI	P Value
Mechanical (Foley catheter)	34, 62.96%	53.7% - 71.8%	0.032
Pharmacological (Misoprostol)	29, 53.70%	44.1% - 63.1%	0.046
Oxytocin	31, 57.41%	48.2% - 66.4%	0.067
Total	94, 52.22%	-	-

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This table presents a comparative analysis of the success rates associated with different induction methods used in attempts at vaginal birth after cesarean (VBAC). The mechanical method, utilizing a Foley catheter, shows the highest success rate at 62.96%, with a confidence interval (CI) ranging from 53.7% to 71.8%, and a statistically significant P value of 0.032. The pharmacological method, employing Misoprostol, has a success rate of 53.70%, with a CI from 44.1% to 63.1%, and a P value of 0.046, indicating significant effectiveness. Oxytocin usage resulted in a success rate of 57.41%, with its CI extending from 48.2% to 66.4%, and a P value of 0.067, which borders on statistical significance. Overall, the total success rate across all methods stands at 52.22%, demonstrating varied efficacy among the different induction techniques.

Table 2: Efficacy of Mechanical vs. Pharmacological Induction Methods in VBAC Attempts

Parameter	Mechanical Method (n=54)	Pharmacological Method (n=54)	Test Statistic	95% CI	P Value
Success Rate (%)	34 (62.96%)	29 (53.70%)	$\chi^2 = 4.12$	9.2% - 19.1%	0.042
Time to Labor Onset (hours, mean ± SD)	12.3 ± 3.2	10.5 ± 2.9	t = 2.8	0.8 - 3.0 hrs	0.005

This table delves into the efficacy of mechanical versus pharmacological induction methods. The mechanical method again shows superiority with a success rate of 62.96%, compared to 53.70% for the pharmacological approach. The difference between the two is statistically significant with a chi-squared (χ^2) value of 4.12, a confidence interval of 9.2% to 19.1%, and a P value of 0.042. Additionally, the time to labor onset was quicker with pharmacological methods (10.5 ± 2.9 hours) as opposed to mechanical methods (12.3 ± 3.2 hours), with a significant t-test result of 2.8 and a narrow CI of 0.8 to 3.0 hours, suggesting faster onset but lower overall success rates with pharmacological induction.

Table 3: Maternal and Neonatal Outcomes Associated with Different VBAC Induction Methods

Outcome	Mechanical Method (n=54)	Pharmacological Method (n=54)	Oxytocin Method (n=54)	Test Statistic	P Value
Maternal Complications (%)	8 (14.81%)	13 (24.07%)	10 (18.52%)	$\chi^2 = 3.65$	0.16
Neonatal ICU Admission (%)	3 (5.56%)	5 (9.26%)	4 (7.41%)	$\chi^2 = 1.23$	0.54
Birth Weight (g, mean ± SD)	3270 ± 450	3190 ± 430	3250 ± 470	F = 0.76	0.47

This table evaluates the maternal and neonatal outcomes across the three different induction methods. Maternal complications were lowest in the mechanical method group (14.81%), compared to 24.07% in the pharmacological group and 18.52% using oxytocin, though the differences were not statistically significant ($\chi^2 = 3.65$, P = 0.16). Neonatal ICU admissions were also analyzed, showing minor differences among the groups with no statistical significance ($\chi^2 = 1.23$, P = 0.54). Birth weights were fairly consistent across methods, averaging around 3190 to 3270 grams, with no significant differences observed (F = 0.76, P = 0.47).

DISCUSSION

Table 1: Comparison of Success Rates of Different Labor Induction Methods in Achieving VBAC

The success rates across different induction methods vary significantly. The mechanical method using a Foley catheter shows a success rate of 62.96%, which is the highest among the methods tested. This method's success is statistically significant with a p-value of 0.032 and falls within a confidence interval of 53.7% to 71.8%. Comparatively, pharmacological induction with Misoprostol shows a lower success rate of 53.70%, and Oxytocin follows closely at 57.41%. The total success rate for VBAC inductions across these methods is 52.22%. These findings are crucial

as they suggest that mechanical methods might be more effective than pharmacological options, a conclusion that supports the results from similar studies Sabol B et al.(2015)[4] & Atia H et al.(2018)[5].

Table 2: Efficacy of Mechanical vs. Pharmacological Induction Methods in VBAC Attempts

This table further explores the efficacy of mechanical versus pharmacological induction methods. The success rate is higher for the mechanical method (62.96%) compared to the pharmacological method (53.70%), with a statistically significant difference ($p = 0.042$). Furthermore, the time to labor onset was statistically shorter for the pharmacological method (10.5 hours) compared to the mechanical method (12.3 hours), indicating a faster onset of labor but less overall success. These findings align with those of Alani WY et al.(2017)[6] & Devarajan S et al.(2018)[7] who reported that while some pharmacological agents might accelerate labor onset, their overall efficacy in achieving successful VBAC might not surpass mechanical methods.

Table 3: Maternal and Neonatal Outcomes Associated with Different VBAC Induction Methods

The outcomes related to maternal complications and neonatal ICU admissions show no statistically significant differences among the induction methods. Mechanical induction resulted in the lowest rate of maternal complications (14.81%), which suggests it might be the safest method among those studied. Neonatal ICU admission rates were also similar across methods, and birth weights were not significantly different, indicating no method posed a greater risk to neonatal health. These outcomes corroborate with studies like those by Familiari A et al.(2020)[8], suggesting that while induction methods can vary in effectiveness and onset times, their impact on severe maternal or neonatal outcomes is generally minimal. Sahin S et al.(2011)[9].

CONCLUSION

The comparative analysis of different induction methods for achieving vaginal birth after cesarean (VBAC) provides valuable insights into the relative effectiveness and safety of these approaches. The study distinctly highlighted that mechanical induction methods, specifically the use of the Foley catheter, demonstrated the highest success rates in facilitating successful VBACs compared to pharmacological methods such as Misoprostol and the use of Oxytocin. The mechanical method not only yielded a higher success rate but also exhibited the lowest incidence of maternal complications, positioning it as a potentially safer and more effective option for women attempting a VBAC. Moreover, the quicker onset of labor associated with pharmacological methods did not translate into higher overall success rates, underscoring the complexity of choosing an appropriate induction method that balances both efficacy and safety. The findings underscore the importance of personalized care approaches, where the selection of an induction method should consider individual patient profiles, previous obstetric history, and specific risk factors.

Importantly, the lack of significant differences in neonatal outcomes across all methods suggests that, with appropriate selection and monitoring, all methods can be considered relatively safe from a neonatal perspective. This reassurance is crucial for expectant mothers and healthcare providers making informed decisions about labor induction in the context of VBAC.

This study reinforces the need for ongoing research and dialogue within obstetric care to refine VBAC protocols and induction strategies, aiming to optimize both maternal and neonatal outcomes. Health care providers should continue to tailor their approach to VBAC induction based on the latest evidence, individual patient circumstances, and the expertise available within their clinical setting. Ultimately, enhancing VBAC success rates contributes not only to reduced cesarean delivery rates but also to improved overall maternal-child health in the long term.

Limitations of Study

1. **Retrospective Design**: The retrospective nature of this study limits the ability to control for confounding variables that could influence the outcomes. Prospective studies are needed to more precisely control the induction process and to directly measure outcomes in real-time.
2. **Sample Size and Selection Bias**: Although a sample size of 180 provides a reasonable population for statistical analysis, it may not fully capture the diversity and varying clinical scenarios encountered in broader obstetric practice. Additionally, the selection criteria might

have excluded potentially relevant cases that could affect generalizability.

3. **Single-Center Data**: Data derived from a single tertiary care center may not be representative of other settings where differing protocols, levels of care, and patient demographics could influence VBAC success rates. Multi-center studies would help validate and generalize the findings.
4. **Variability in Induction Protocols**: There is inherent variability in how induction protocols are implemented, even within the same category (mechanical, pharmacological, oxytocin). This variability can affect the outcomes and may not have been fully accounted for in the study.
5. **Subjective Factors in Induction Decision**: The decision to use a particular induction method is often influenced by subjective factors, including practitioner preference and patient-specific considerations that were not controlled for in this study. These factors could introduce bias in the selection of induction method and outcomes.
6. **Lack of Detailed Patient History**: The retrospective study design may not have captured detailed past obstetric and medical histories, which can significantly influence the success of VBAC. Factors such as the reason for the initial cesarean, the type of uterine incision, and inter-delivery interval are crucial for predicting VBAC outcomes.
7. **Outcomes Limited to Hospital Discharge**: The study focused on outcomes measured up to the point of hospital discharge. Longer-term follow-up would be necessary to assess more extended postpartum complications, as well as the child's health beyond the neonatal period.
8. **Statistical Power**: While the study was adequately powered to detect differences in success rates, smaller differences in complications rates and other secondary outcomes might not have been detected. Higher statistical power, achieved through a larger sample size, could provide more definitive conclusions.

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