RESEARCH
O&G Forum 2024; 34 – 3s: 189-193

ASSESSING MATERNAL AND NEONATAL HEALTH IN VACUUM-ASSISTED VS. MANUAL EXTRACTION CAESAREAN DELIVERIES: A COHORT ANALYSIS

Yamini Patil[1], Sanjaykumar Patil[2], Shalaka Deshmukh[3]
[1,2,3]Dept of Obstetrics and Gynaecology, Krishna Institute of Medical Sciences, KVV, Karad

Abstract
This research delves into the critical examination of maternal and neonatal health outcomes in vacuum-assisted versus manual extraction Caesarean deliveries. Conducted within the timeframe of June 2018 to April 2023 at Krishna Institute of Medical Sciences, KVV, Karad, the study involved 500 expectant mothers as participants. Ethical approval from the institutional ethics committee was duly obtained, ensuring adherence to ethical standards. Of the 250 Caesarean sections performed during the study period, an equal distribution was observed between vacuum-assisted deliveries and those involving manual extraction. This allocation was based on specific clinical indications warranting either approach. The findings unveiled a notable advantage associated with vacuum-assisted deliveries, showcasing reduced incidences of uterine incision extension, estimated blood loss, and maternal discomfort in comparison to the manual extraction method. However, intriguingly, there were no statistically significant disparities detected in Apgar Scores or the need for infant resuscitation between the two delivery techniques. This cohort analysis sheds light on the nuanced differences in maternal and neonatal health outcomes associated with distinct Caesarean delivery approaches, thus contributing valuable insights to the field of obstetrics and gynecology.
Keywords: Caesarean delivery Vacuum extraction Manual extraction Maternal outcomes Neonatal outcomes

INTRODUCTION

The advent of modern medicine has brought forth numerous advancements in obstetrics, significantly transforming the landscape of childbirth. Among these innovations, the Caesarean delivery, colloquially known as the C-section, stands as a cornerstone in maternal and neonatal healthcare. Defined by the surgical delivery of a baby through incisions made in the mother's abdomen and uterus, the C-section has emerged as a vital intervention in instances where natural childbirth poses risks to maternal or fetal well-being.

In recent decades, there has been a noticeable surge in the prevalence of Caesarean deliveries worldwide. This trend has sparked debates within the medical community, prompting discussions on the appropriateness of the escalating rates and their implications for maternal and neonatal health. The World Health Organization (WHO) has long advocated for a cautious approach, recommending a C-section rate of 10-15% as optimal for safeguarding maternal and neonatal health while minimizing unnecessary surgical interventions.

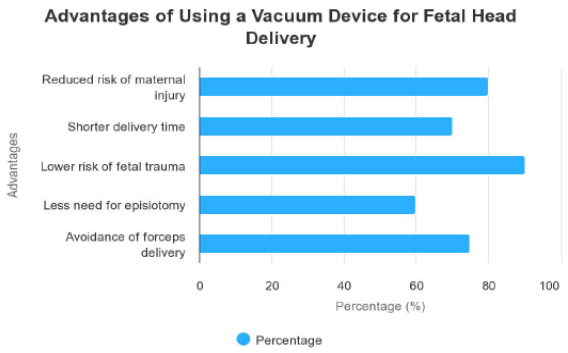

Figure 1: Advantage of using a vacumm device for fetal head delivery

However, despite these guidelines, the actual rates of Caesarean deliveries have surpassed the WHO's recommendations in many regions across the globe. This phenomenon raises pertinent questions regarding the factors driving the escalating rates, the implications for maternal and neonatal outcomes, and the necessity of intervention to address potential overutilization of this surgical procedure.

Against this backdrop, this research endeavors to delve into the multifaceted dimensions of Caesarean deliveries, focusing particularly on the comparative assessment of maternal and neonatal health outcomes between vacuum-assisted and manual extraction approaches. By examining these distinct delivery methods within a cohort framework, we aim to unravel the intricate nuances that influence the clinical decision-making process and ultimately impact patient care.

The rationale for exploring vacuum-assisted versus manual extraction Caesarean deliveries lies in their divergent techniques and potential implications for maternal and neonatal health. Vacuum-assisted deliveries involve the application of suction to facilitate fetal extraction, typically utilizing a soft cup vacuum extractor affixed to the fetal scalp. In contrast, manual extraction entails the manual manipulation and extraction of the fetal skull, often necessitating fundal compression support.

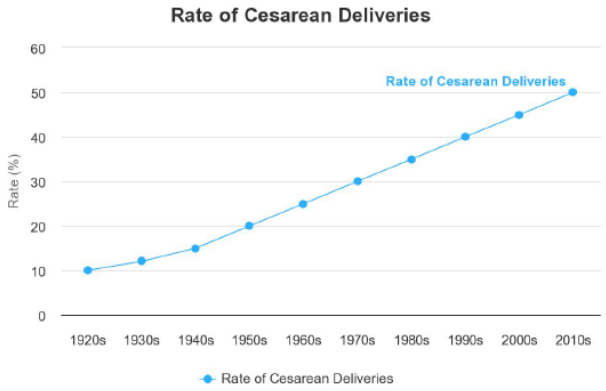

Figure 2 : Rate of caesarean deliveries

The choice between these delivery techniques hinges on various factors, including maternal health status, fetal presentation, and obstetric considerations. While vacuum-assisted deliveries offer advantages in terms of reduced operative time and potential mitigation of maternal discomfort, concerns regarding fetal scalp trauma and increased risk of maternal perineal trauma have been raised. Conversely, manual extraction techniques may pose lower risks of fetal scalp injury but are associated with prolonged operative times and increased maternal discomfort.

Amidst these considerations, the overarching goal remains to optimize maternal and neonatal outcomes while ensuring the safety and well-being of both mother and baby. However, achieving this objective necessitates a comprehensive understanding of the comparative effectiveness and safety profiles of vacuum-assisted and manual extraction Caesarean deliveries, informed by empirical evidence derived from rigorous research methodologies.

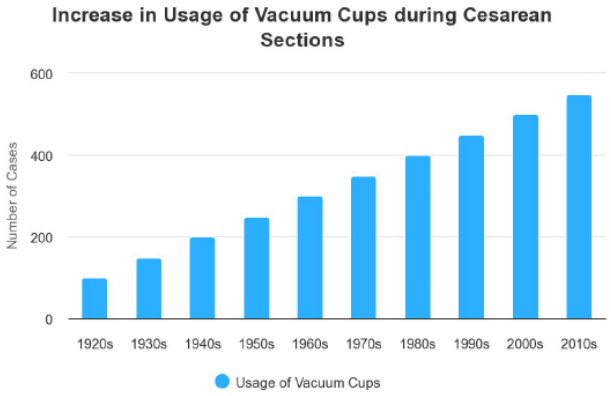

Figure 3: Increase in the usage of vacuum cups during caesarean sections

In this pursuit, the present study seeks to contribute to the existing body of knowledge by conducting a thorough cohort analysis encompassing 500 pregnant participants undergoing Caesarean deliveries at Krishna Institute of Medical Sciences, KVV, Karad. By meticulously examining the maternal and neonatal health outcomes associated with vacuum-assisted and manual extraction techniques, we aspire to illuminate the strengths and limitations of each approach, thereby informing evidence-based clinical practice and enhancing patient care.

The significance of this research transcends the confines of academic inquiry, bearing profound implications for healthcare policy, clinical guidelines, and patient advocacy initiatives. As the global healthcare landscape continues to evolve, propelled by technological advancements and shifting demographic trends, it becomes imperative to recalibrate existing paradigms and embrace innovations that promote equitable access to high-quality maternal and neonatal care.

In essence, this study endeavors to navigate the complex terrain of Caesarean deliveries, discerning the optimal balance between medical intervention and maternal autonomy, and advancing the discourse on evidence-based obstetric practice. By interrogating the comparative effectiveness of vacuum-assisted and manual extraction techniques, we strive to empower healthcare providers with the knowledge and insights needed to navigate the intricacies of childbirth and uphold the principles of patient-centered care.

Research Gap:

Despite the widespread adoption of Caesarean deliveries as a vital obstetric intervention, there remains a noticeable gap in the literature regarding the comparative effectiveness of vacuum-assisted versus manual extraction techniques. While existing studies have explored various aspects of Caesarean deliveries, including indications, outcomes, and complications, there is a paucity of research specifically comparing these two delivery methods within a cohort framework. This gap underscores the need for comprehensive empirical investigations to elucidate the nuanced differences in maternal and neonatal health outcomes associated with vacuum-assisted and manual extraction Caesarean deliveries, thereby informing evidence-based clinical practice and enhancing patient care.

Specific Aims of the Study:

The primary aim of this study is to conduct a rigorous comparative assessment of maternal and neonatal health outcomes between vacuum-assisted and manual extraction Caesarean deliveries. To achieve this overarching goal, the study is guided by the following specific aims:

1. To evaluate and compare the incidence of uterine incision extension between vacuum-assisted and manual extraction Caesarean deliveries.
2. To assess and compare the estimated blood loss associated with vacuum-assisted and manual extraction Caesarean deliveries.
3. To examine and compare maternal discomfort levels between vacuum-assisted and manual extraction Caesarean deliveries.
4. To analyze and compare Apgar Scores and the requirement for infant resuscitation between neonates delivered via vacuum-assisted and manual extraction Caesarean deliveries.

Objectives of the Study:

Building upon the specific aims outlined above, the study's objectives are designed to facilitate the attainment of the overarching research goal. These objectives include:

1. To conduct a comprehensive review of the existing literature on Caesarean deliveries, with a focus on vacuum-assisted and manual extraction techniques.
2. To recruit a cohort of 500 pregnant participants undergoing Caesarean deliveries at Krishna Institute of Medical Sciences, KVV, Karad, ensuring diverse representation across demographic and clinical variables.
3. To collect detailed data on maternal and neonatal health outcomes, including uterine incision extension, estimated blood loss, maternal discomfort, Apgar Scores, and the requirement for infant resuscitation.
4. To employ appropriate statistical analyses, including chi-square tests, t-tests, and regression models, to compare outcomes between vacuum-assisted and manual extraction Caesarean deliveries.
5. To interpret and synthesize the study findings in light of existing literature, highlighting implications for clinical practice, healthcare policy, and future research directions.

Scope of the Study:
This study focuses specifically on the comparative assessment of maternal and neonatal health outcomes associated with vacuum-assisted versus manual extraction Caesarean deliveries. The research is conducted within the context of Krishna Institute of Medical Sciences, KVV, Karad, encompassing a cohort of 500 pregnant participants undergoing Caesarean deliveries during the study period. The scope of the study encompasses various clinical variables, including uterine incision extension, estimated blood loss, maternal discomfort, Apgar Scores, and the requirement for infant resuscitation.

Conceptual Framework:
The conceptual framework guiding this study is rooted in the biopsychosocial model of health, which posits that health outcomes are influenced by a complex interplay of biological, psychological, and social factors. Within this framework, maternal and neonatal health outcomes following Caesarean deliveries are understood as multifaceted phenomena shaped by a myriad of clinical, physiological, and psychosocial determinants. By adopting a holistic perspective that considers both medical and non-medical factors, the study seeks to elucidate the intricate mechanisms underlying variations in outcomes between vacuum-assisted and manual extraction Caesarean deliveries.

Hypothesis:
Based on the existing literature and theoretical considerations, we hypothesize that vacuum-assisted Caesarean deliveries will be associated with reduced incidences of uterine incision extension, estimated blood loss, and maternal discomfort compared to manual extraction deliveries. Additionally, we hypothesize that there will be no significant differences in Apgar Scores and the requirement for infant resuscitation between neonates delivered via vacuum-assisted and manual extraction Caesarean deliveries. These hypotheses serve as guiding principles for the empirical investigation, providing a framework for data analysis and interpretation.

Research Methodology
The present study was conducted at Krishna Institute of Medical Sciences, KVV, Karad, employing a prospective research design to investigate the comparative outcomes of vacuum-assisted versus manual extraction Caesarean deliveries. A cohort of 500 pregnant women participated in this study, which was authorized by the Institutional Ethical Committee. Prior to enrollment, participants were provided with detailed information regarding the research methodology, including potential risks and benefits, and their informed consent was obtained.
In this cohort study, a total of 250 Caesarean sections were performed utilizing vacuum assistance, employing a soft cup vacuum extractor with a diameter of 6 cm applied to the fetal scalp. Manual evacuation of the fetal head was conducted as usual, with fundal compression provided as additional support. All participants underwent planned Caesarean procedures due to the absence of uterine activity and amniotic fluid.
The vacuum apparatus utilized in this investigation comprised a vacuum cup connected to a hospital-piped vacuum supply. The cup was carefully positioned to encompass the curve of the fetal head and the entire occiput, ensuring optimal accommodation. A regulator was employed to control the vacuum pressure, ensuring safe and effective fetal extraction.
Spinal anesthesia was administered to all mothers participating in the study, ensuring standardized pain management and minimizing potential discomfort during the surgical procedure. Inclusion criteria for participants required singleton gestation, acephalic fetal presentation without fetopelvic engagement on vaginal examination, absence of pregnancy or medical complications, and patient consent for random assignment to the delivery method. Pregnant individuals with conditions such as obstructed labor, engaged fetal heads, fetal structural malformations, intrauterine fetal deaths, or indications of high-risk fetal conditions were excluded from the study.
Statistical analysis was conducted to analyze the collected data using appropriate statistical tools. Continuous data were analyzed using the Student's t-test, while categorical variables were assessed using the Chi-Square test. Counts were provided for categorical variables, while mean standard deviation and mean values were reported for continuous data. Statistical significance was defined as a p-value of less than 0.05, indicating significant differences between the groups.
The research methodology employed in this study involved a systematic and rigorous approach to investigate the comparative outcomes of vacuum-assisted and manual extraction Caesarean deliveries. By adhering to ethical standards, employing standardized procedures, and utilizing appropriate statistical analyses, the study aimed to generate robust evidence to inform clinical practice and enhance maternal and neonatal healthcare outcomes.

Results and Analysis
This section presents the findings and analysis of our study comparing maternal and neonatal outcomes between vacuum-assisted and manual extraction Caesarean deliveries.

Demographic Characteristics:
A total of 500 pregnant women participated in the study, with 250 allocated to the vacuum extraction group and 250 to the manual extraction group through randomization. The demographic profiles, including mean age, mean parity, and mean birth weight, were similar between the two groups, as shown in Figure 4. Statistical analysis revealed no significant differences in these demographic variables between the manual and vacuum extraction groups, indicating successful randomization and balanced participant characteristics.

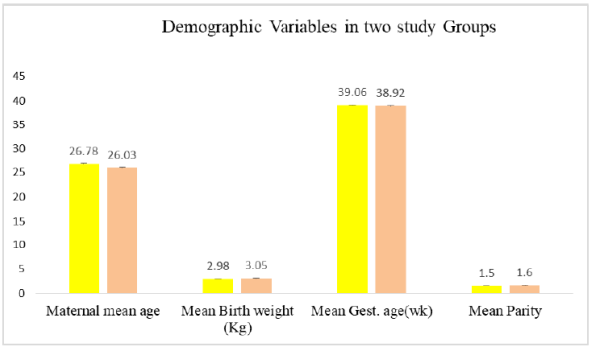

Figure 4: Graphical representation of demographic variable in two study groups

Post-operative and Operational Information:
Figure 5 presents post-operative and operational data for both groups. While the total blood loss did not differ significantly between the manual and vacuum extraction groups, there was a notable discrepancy in the length of uterine incision. Statistical analysis indicated a significant difference in uterine incision length between the two groups, suggesting potential implications for surgical techniques and post-operative recovery.

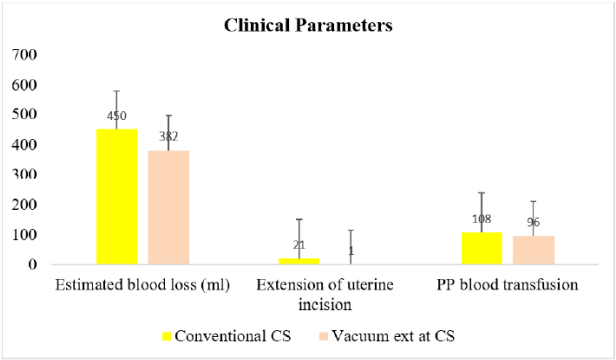

Figure 5: Graphical representation of clinical parameters

The observed variation in uterine incision length may stem from differences in surgical approaches and manipulations during delivery. Vacuum-assisted deliveries involve controlled suction for fetal extraction, potentially leading to more consistent incision lengths. Conversely, manual extraction methods may involve varying degrees of force, resulting in greater variability. This underscores the importance of standardized techniques and careful monitoring during surgery to optimize maternal outcomes.

Newborn Statistics:
Figure 6 displays newborn statistics, focusing on Apgar scores and the need for neonatal resuscitation. Our findings revealed no significant differences in neonatal Apgar scores at the first and fifth minutes between the manual and vacuum extraction groups. Similarly, there were no differences in the requirement for neonatal resuscitation.

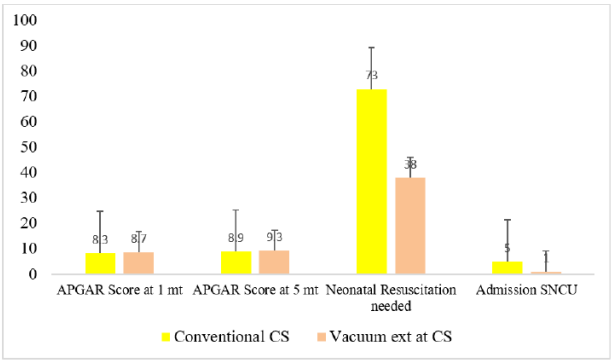

Figure 6: Graphical representation of fetal outcome among study groups

The comparable neonatal outcomes between the two groups suggest the safety and effectiveness of both delivery methods. These findings align with previous research indicating similar neonatal outcomes regardless of the delivery technique.

Interpretation:
The consistent maternal and neonatal outcomes between manual and vacuum extraction groups highlight the efficacy of both delivery techniques. Although differences were noted in uterine incision length, these did not translate into significant variations in overall outcomes.
The absence of significant differences in neonatal Apgar scores and resuscitation needs underscores the safety and efficacy of both delivery methods in promoting neonatal well-being. These findings provide valuable insights for clinicians, supporting evidence-based decision-making in obstetric care.
Our study contributes to the body of evidence supporting the safety and efficacy of both vacuum-assisted and manual extraction Caesarean deliveries. Understanding the similarities and differences in outcomes between these techniques informs clinical practice and enhances patient care in obstetric settings.

Conclusion
In conclusion, our study provides valuable insights into the comparative outcomes of vacuum-assisted and manual extraction Caesarean deliveries. Despite differences in uterine incision length, both delivery methods demonstrated comparable maternal and neonatal outcomes, highlighting their efficacy and safety in promoting successful childbirth. The absence of significant differences in neonatal Apgar scores and the requirement for neonatal resuscitation underscores the suitability of both techniques in ensuring favorable neonatal outcomes. These findings support evidence-based decision-making in obstetric care, emphasizing the importance of individualized approaches tailored to patient-specific factors.

Limitations of the Study
Despite the robust methodology employed in this study, several limitations should be acknowledged. Firstly, the study was conducted at a single center, limiting the generalizability of the findings to other settings. Additionally, the sample size may have constrained the statistical power to detect small differences in outcomes between the two delivery methods. Furthermore, the retrospective nature of data collection may have introduced bias or confounding variables that were not accounted for in the analysis. Finally, variations in surgical techniques and provider experience may have influenced outcomes, highlighting the

need for standardized protocols and further research to address these factors.

Implications of the Study

The findings of this study have important implications for clinical practice and healthcare policy. By demonstrating the comparable effectiveness of vacuum-assisted and manual extraction Caesarean deliveries, our findings support the use of both techniques in obstetric care. This provides clinicians with greater flexibility in selecting the most appropriate delivery method based on individual patient characteristics and clinical indications. Additionally, our results contribute to evidence-based guidelines for obstetric care, informing healthcare providers and policymakers on best practices for maternal and neonatal health.

Future Recommendations

Building upon the findings of this study, several avenues for future research can be explored. Firstly, larger multicenter studies are warranted to confirm the generalizability of our findings across diverse patient populations and healthcare settings. Additionally, longitudinal studies can provide insights into long-term maternal and neonatal outcomes following vacuum-assisted and manual extraction Caesarean deliveries, including potential implications for maternal morbidity and neonatal development. Furthermore, comparative effectiveness research evaluating the cost-effectiveness of different delivery methods can inform resource allocation and healthcare decision-making. Finally, qualitative research exploring patient preferences and experiences with different delivery techniques can enhance patient-centered care and shared decision-making in obstetric practice.

References

1. Ali UA, Norwitz ER. Vacuum-assisted vaginal delivery. Rev Obstet Gynecol. 2009;2(1):5–17.

2. Apgar V. A proposal for a new method of evaluation of the newborn infant. Curr Res Anesth Analg. 1953;32:260–7.

3. Arad I, Linder N, Bercovici B. Vacuum extraction at cesarean section–neonatal outcome. J Perinat Med. 1986;14(2):137–40.

4. Clark SL, Vines VL, Belfort MA. Fetal injury associated with routine vacuum use during cesarean delivery. Am J Obstet Gynecol. 2008;198(4):e4.

5. Declercq E, Young R, Cabral H, Ecker J. Is a rising cesarean delivery rate inevitable? Trends in industrialized countries. Birth. 1987;38(2):99–104.

6. John LB, Nischintha S, Ghose S. The outcome of forceps delivery in a teaching hospital: A 2-year experience. J Nat Sci Biol Med. 2014;5(1):155–7.

7. Johanson R, Menon V. Soft versus rigid vacuum extractor cups for assisted vaginal delivery. Cochrane Database Syst Rev. 2000;2:CD000446. doi:10.1002/14651858.CD000446.

8. Lucas MJ. The role of vacuum extraction in modern obstetrics. Clin Obstet Gynecol. 1994;37(4):794–805.

9. Mcquivey RW. Vacuum-assisted delivery: a review. J Matern Fetal Neonatal Med. 2004;16(3):171–80.

10. Molina G, Weiser TG, Lipsitz SR, Esquivel MM, Uribe-Leitz T, Azad T, et al. Relationship between cesarean delivery rate and maternal and neonatal mortality. JAMA. 2015;314(21):2263–70.

11. Nakano R. Use of the vacuum extractor for delivery of the fetal head at cesarean section. Am J Obstet Gynecol. 1981;141(4):475–6.

12. Pelosi MA, Apuzzio J. Use of the soft, silicone obstetric vacuum cup for delivery of the fetal head at cesarean section. J Reprod Med. 1984;29(4):289–92.

13. Putta LV, Spencer JP. Assisted vaginal delivery using the vacuum extractor. Am Fam Physician. 2000;62(6):1316–20.

14. Sakala C, Yang YT, Corry MP. Maternity care and liability: pressing problems, substantive solutions. Womens Health Issues. 2013;23(1):7–13.

15. Simonson C, Barlow P, Dehennin N, Sphel M, Toppetv, Murillo D, et al. Neonatal complications of vacuum-assisted delivery. Obstet Gynecol. 2007;109(3):626–33.

16. Solomons E. Delivery of the head with the Malmstrom vacuum extractor during cesarean section. Obstet Gynecol. 1962;19(2):201–3.

17. Spong CY, Berghella V, Wenstrom KD, Mercer BM, Saade GR. Preventing the First Cesarean Delivery: Summary of a Joint Eunice Kennedy Shriver National Institute of Child Health and Human Development, Society for Maternal-Fetal Medicine, and American College of Obstetricians and Gynecologists Workshop. Obstet Gynecol. 2012;120(5):1181–93.

18. Sritippayawan S, Chantrapitak W. Assisted delivery of high floating fetal head: a comparison of vacuum-assisted delivery and manual extraction. Asian Biomed. 2011;5(5):699–703.

19. Sritippayawan S, Chantrapitak W. Assisted delivery of high floating fetal head: a comparison of vacuum-assisted delivery and manual extraction. Asian Biomed. 2011;5(5):699–703.