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Evaluation of Maternal and Fetal Outcomes in Caesarean Delivery UtilizingVacuum Assistance following Pelvimetry: A Cross Sectional Study

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Abstract

Background: The use of Caesarean section has greatly increased globally in the past decades, exceeding the threshold recommended by WHO even when done medically or for elective purposes.

Objective: To evaluate the maternalandfetaloutcomesincaesareandeliveryutilizingpelvimetryand vacuum assistance.

Materials and Methods: This cross-sectional study was done in a teaching hospital, Islamabad with 180 pregnant women as subjects. The study was approved by the IRB. 80 C-sections were done using vacuum assistance following pelvimetry. All the patients were given planned C-sections because of no uterine activity and amniotic fluid.

Results: No significant differences were observed between the two groups in terms of mean age, parity, or mean birth weight. The results also demonstrated that there wasn't a significant difference in how much blood the mothers lost between the two groups (p=0.07). However, the size of the cut made in the mother's womb (uterine incision) was noticeably different between the two groups. There weren't any differences between the babies in the two groups when it comes to their health scores (Apgar scores) at one and five minutes after birth (p=0.06). Additionally, there wasn't a difference in the number of babies who needed special help breathing (neonatal resuscitation) or who needed to be admitted to a special care unit (SNCU) (p=1.01).

Conclusion: Vacuum-assisted Caesarean delivery is more effective than manual extraction in minimizing blood loss, uterine incision extension, and maternal discomfort during Caesarean section.

Keywords: Cesarean-Section, Obstetric Surgical Procedures, Pregnancy Complications, Postoperative Complications, Maternal Health Services
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Introduction

The rate of cesarean deliveries has risen significantly in the past two decades and is more than 55% in most countries[1]. Based on NFHS-5's data, the cesarean section rate globally is 21.5% higher than what the World Health Organization recommends as a threshold of 15%[2]. Although there are constant attempts to improve and reduce use of cesarean sections through public health programs[3], the occurrence of these deliveries increases at a steady pace4. As a result, healthcare providers face an increased number of clinical variants which require multiple modes of delivery to treat various medical situations and achieve better results. Today, vacuum-assisted ways have become more common in cesarean sections as they are largely accepted and

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considered to be a safe option for surgical delivery through vagina[5,6]. This is especially important in light of the problems related to making correct incisions during elective cesarean sections when contracted lower uterine segment is absent. Moreover, the fetal head does not securely lodge in the pelvis after elective repeat cesarean operation. Without a vacuum, doctors might need to use other methods to deliver the baby. These methods, like forceps or special cuts in the mother's womb (including a J-shaped cut), can be uncomfortable for both the mother and the baby[7].

The validity of commonly using suction during cesarean delivery has not been established. Many case reports question the superior outcomes[8,9]. Through a thorough review of rare cases involving vacuum-assisted vaginal delivery that led to fetal harm, Simonson et al[10]. underscored the scarcity of such incidences[11]. On the other hand, a suction device is an accepted part of obstetric practice that often uses piped-vacuum supply as the vacuum source. In order to produce the necessary vacuum for ventouse distribution, it is attached to a pressure reduction valve. This study is aimed at comparing the outcomes of both mothers and babies with vacuum-assisted delivery versus manual extraction method during cesarean section.

High rates of cesarean deliveries increase over the years to various factors such as rapid increase in pregnancies with high-risk profiles and change in obstetric medical norms/ legal landscape[12]. However, if the fetal head is large or appropriately positioned, delivering a baby through cesarean surgery can be difficult sometimes. This difficulty is related to the occurrence of maternal complications, namely lateral expansions in uterine incisions and cervix-level abrasion. For these cases, forceps, elevated background pressure with manual extraction or uterine incisions may be used however such procedures might be painful for the mother as well as a fetus[13]. Lately, there has been an increased use of vacuum cups during cesarean sections in the assistance of fetal head delivery. In 1962, Solomon recommended vacuum removal of fetal head which he claimed would help to relieve pressure on the fetus's head, shorten labour and reduce caesarean section[14].

Obstetric procedures have hypoxia, incision size and vascular injury associated with it. The vacuum extractor looks like a metal syringe, which is connected to a soft rubber canister laying on the fetal head. The procedure of eviction would be used to empty the canister and pull into traction on top off the base cup, extracting a kid. However, this early device was far from perfect with several weaknesses like lack of pelvic curve, low vacuum strength and non-refill after initial syringe evacuation. Recently, there has been a shift towards using bell-shaped and hemispherical silicone rubber cups.[15]. The metal cup is commonly favored because of its ability to remain in the occiput-posterior placing and allows easy manipulation while taking into consideration the rigidity associated with a higher risk of fetal scalp injury[16]. In contrast, the soft cup vacuum extractor is far less traumatic in that it does not inflict much damage on neonates' scalps as compared to metals'. Some variations feature an internally mounted pressure relief valve hence enabling the quick-illumination of proper tension and handling easily. These extractors can be used either by hand with a vacuum or they may be powered by an electric suction device[17].

Vacuum-assisted cesarean deliveries may present challenges in cases where both the mother and fetus are affected by neonatal issues such as Chignon (iatrogenic caput succedaneum) or cephalhematomas, which can potentially lead to serious complications like subgaleal or sub-aponeurotic bleeding. Peripheral side effects may include sub conjunctival hemorrhage, lacerations, and retinal hemorrhaging. In comparison to forceps or traditional cesarean delivery, vacuum extraction poses fewer risks for the mother, with potential side effects including Perineal lacerations, hematoma formation, and blood loss, along with complications such as urine retention that may manifest as symptoms of fecal and urinary incontinence.

When the baby's head is disproportionately large compared to the mother's pelvic opening, it's known as CPD. This condition can hinder vaginal delivery and may require a cesarean section2. Cephalopelvic disproportion (CPD) can be caused by several factors, including:

Pelvic issues: A contracted pelvis, bony growths (pelvic exocytose), or spinal misalignment (spondylolisthesis) can make the pelvic opening too narrow.

Large baby: Gestational diabetes, other medical conditions, post-term pregnancies, or hydrocephalus can lead to a baby's head being larger than normal. Therefore, pelvimetry is recommended before going for C-section or vacuum. The rationale of the study was to evaluate the maternal and fetal outcomes in caesarean delivery utilizing vacuum assistance following pelvimetry.

Material and Method:

Study design, Area and Period:

This cross-sectional study was done between June to December 2023 in HBS General hospital, Islamabad with 180 pregnant women as subjects. The study was approved by the institutional ethical committee of HBS medical and Dental College, Islamabad.

Inclusion criteria:

All conceived women with singleton pregnancy at or beyond 37 weeks' gestation, with the baby positioned head-down.

Exclusion Criteria:

All the conceived women who has giving birth before 37 weeks of pregnancy or having more than one baby

Study Variables:

Dependent: Surgery Patients satisfaction with perioperative service

Independent Variables: Socio-Demographic Characteristics: Age, sex, occupation, Marital Status; Education level, Income, and residence. Clinical Characteristics: Experience with hospitalization, History of co-morbid diseases, complications, Type of anesthesia, Length of hospitalization, expectation of service, Types of operation, and Payment status for treatment. Organizational factor: ward or beds cleanliness, Availability medication and investigation finding under hospital, food and water supply, cleanliness bathroom, and cleanliness of latrines. Satisfaction on Five Dimensions: Discomfort and Needs, fear and Concerns, patient –Staff Relation Ship, Service, and Information.

Data Acquisition:

After we explained the risks and benefits of participating in this research study, we got written consent from all the mothers involved. This was a type of study where we compared different delivery methods. In all cases, we delivered the babies through C-sections but pelvimetry was done before the procedures. We used a special soft cup suction device on the baby's head and then carefully removed the baby's head by hand while pressing on the mother's belly for support. All the mothers who had planned C-sections were those who weren't experiencing any water breaking or contractions. Mothers who received spinal anesthesia were those with special situations, such as only having one baby, having an unusual placenta, or not having any major health problems during their pregnancy. The patients were randomly allocated to the intervention method with instances of obstructed labor, presented engaged fetal heads, fetal structural malformations and intrauterine deaths on exclusion.

The vacuum apparatus that was used in the study consisted of a vacuum cup attached to a vacuum source, uniformly encasing each fetal head shape over a soft silicone obstetric vacuum cap having 6cm. To achieve the required vacuum for ventouse delivery, a hospital's piped-vacuum supply with a wall mounted hand vascular regulator and an anti-emboli trap was used based on 300 mmHg pressure. This pressure was much lower than the methods of assisted vaginal delivery needed (550-600 mm Hg). At Full Vacuum (300 mmHg), the calibration of the vacuum was conducted, then attached to the suction line that had a suction cup.

Following the rupture of water sac, a cut was made in the mother's womb and a special cup was placed on the top of the baby's head. The researchers took off another tool that had been used earlier. Then, they gently turned on a suction machine that held the cup firmly in place. After about 15-20 seconds, they pushed down on the mother's belly while carefully pulling the baby out through the cut. To finish, they held the machine near the base of the cup and continued to push down gently. Once the baby's head was delivered, they turned off the suction and removed the cup. The good news is that securing the cup only required very low suction pressure.

In normal deliveries where the mother wasn't pushing the baby out on her own (manual extraction), if pulling gently with hands didn't work after two tries, doctors might use special tools like forceps or even small cuts to help deliver the baby. The entire delivery process

was timed, starting from when the baby's head was completely out to when the sac surrounding the baby (fetal membranes) appeared through the mother's womb (lower uterine segment) after it was cut (amniotomy) or naturally pushed out (herniation).

The doctor checked the baby's overall health (Apgar score)18 at one and five minutes after birth, which was a perfect. Before each baby went home, they were given a thorough checkup, especially their head. We collected information about the mom (age, weight) and the delivery (type, how long it took, any blood loss). We also recorded the baby's weight, Apgar score, and any injuries during birth. This included things like scratches, bruises, or bumps on the head. All this information, about both mom and baby, was carefully documented.

Statistical analysis was conducted on the data to analyze them with a student t test for a continuous data and a chi-square test for categorical variables. Distributions are counts reported for categorical variables and also mean values and standard deviations (SD) for continuous data were reported. On the p-value threshold, the chosen statistical significance level was 0.05.

Results:

A total of 180 women were randomly assigned to two groups: 90 to the vacuum extraction group and 90 to the manual extraction group. Information about their age, number of previous pregnancies (parity), and newborn weight is presented in Figure 1.

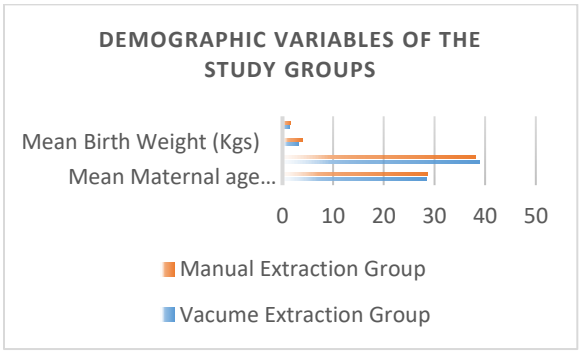

Figure 1: Demographic variables of the study groups

Importantly, there were no significant differences between the two groups in terms of average age, average parity, or average birth weight.

Figure 2 shows details about what happened after the surgery (post-operative) and during the surgery (operational) for both manual and vacuum extraction groups. There wasn't a significant difference in how much blood the mothers lost between the two groups. However, the size of the cut made in the mother's womb (uterine incision) was noticeably different between the two groups.

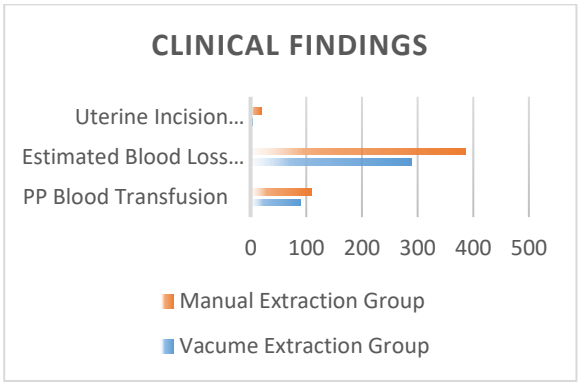

Figure 2: Clinical parameters of the study groups

Figure 3 shows information about the newborn babies in both the manual and vacuum extraction groups. The good news is that there weren't any differences between the babies in the two groups when it comes to their health scores (Apgar scores) at one and five minutes after birth. Additionally, there wasn't a difference in the number of babies who needed special help breathing (neonatal resuscitation) or who needed to be admitted to a special care unit (SNCU).

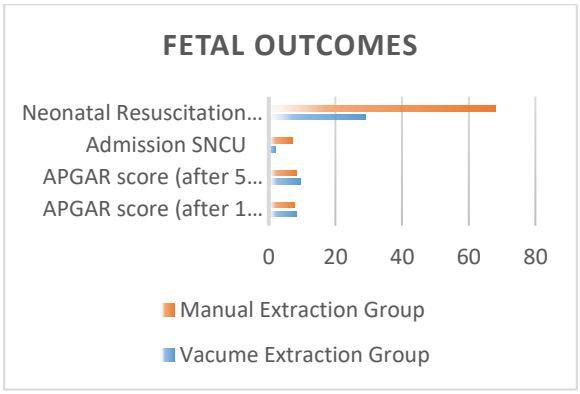

Figure 3: Fetal outcomes among the study groups

Discussion:

Over the past many years, there is an increasing popularity of cesarean deliveries worldwide. As a result, there's been a growing interest in safe and effective ways to assist with delivery during C-sections. This study compares the use of a vacuum extractor to manually deliver a baby's head during a C-section to assess the impact on both mother and baby. It's worth noting that the first use of a soft vacuum cup for C-sections was reported by Pelosi and Apuzzio.[8]

This study tested a new method using soft vacuum cups to deliver babies during C-sections. While it successfully delivered 35 babies with no deaths, including planned (elective) and unplanned C-sections, the method became less popular. This is because the cups often came loose (dislocated) or didn't work (failed). Importantly, there weren't any problems with the mother's surgery or womb needing stretching (dilation) in these cases.

Another study compared vacuum extraction to manual delivery in 18 planned C-sections.[17] There weren't any major differences between the groups in terms of baby's weight, health based on cord blood tests, or the time it took to deliver the baby after the incision was made in the mother's womb. While the incision took slightly longer to complete the delivery with the vacuum (compared to manual), this difference wasn't considered important in real-world situations (clinically significant).

A recent major study compared two methods for delivering babies during planned C-sections: using a soft vacuum cup (vacuum-assisted delivery) or manual extraction.[19] Both groups had 90 participants. The study found that the vacuum method significantly reduced the time it took to deliver the baby's head compared to manual extraction (around 65 seconds vs 86 seconds). Importantly, there were no differences in the babies' health scores (Apgar scores) or any injuries (chignon) between the groups. There was slightly more blood loss in the vacuum group, but this difference wasn't statistically significant. Overall, the study suggests that vacuum-assisted delivery during C-sections can be a faster, less uncomfortable option for mothers, and it doesn't require prolonged pushing on the belly (fundal pressure).

This study found that the time it took to deliver the baby after the incision in the mother's womb (U-D interval) was significantly shorter in the vacuum extraction group compared to the conventional C-section group. This is important because other research has shown that a longer U-D interval can have negative effects on both the mother and baby.

While the amount of blood loss during delivery was lower in the vacuum group compared to the conventional C-section group, this difference wasn't statistically significant (meaning it could be due to chance).

Similar to other studies, there wasn't a significant difference between the two groups in terms of the babies' health scores (Apgar scores).

This study, similar to one by Pelosi et al., found a higher rate of needing a larger incision in the mother's womb (uterine incision extension) in the vacuum extraction group compared to the conventional C-section group.

Overall, using a special vacuum device connected to the hospital's suction system during a C-section appears to be a safe and effective way to help deliver the baby's head. This method may also make the overall C-section delivery process easier.

Conclusion:

This study suggests that using a vacuum to deliver the baby's head during a C-section (vacuum-assisted cesarean delivery) may be a better option than manually pulling the baby out. The vacuum method might lead to less blood loss for the mother, smaller incision in the mother's womb (uterine incision extension) and less discomfort for the mother

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