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Short-Term Maternal and Neonatal Outcomes following Operative Vaginal Deliveries: A Comparative Observational Study

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ABSTRACT

Background: Operative Vaginal Delivery (OVD), comprising forceps and vacuum-assisted births, remains an essential obstetric intervention, especially in low-resource settings. This study assesses and compares the short-term maternal and neonatal outcomes of these two OVD techniques.

Methods: A facility-based observational study was conducted between October 2017 and September 2018. Women undergoing operative vaginal delivery (forceps or vacuum) with proper indications and informed consent were included. Maternal complications (e.g., perineal tears, PPH, cervical tears) and neonatal outcomes (e.g., APGAR scores, SNCU admission, injuries) were evaluated and statistically compared.

Results: Out of 113 OVDs, 83 were vacuum-assisted and 30 forceps-assisted. Maternal morbidities such as perineal tears (56.7% vs 19.3%), PPH (43.3% vs 10.8%), and cervical tears (23.3% vs 2.4%) were significantly higher in the forceps group. Neonatal external injuries were slightly higher with forceps, but cephalohematoma was more frequent in vacuum-assisted deliveries. SNCU admissions were significantly higher with forceps (41.4%) than with vacuum (21.3%). However, no significant differences were observed in Apgar scores or final neonatal discharge outcomes.

Conclusion: Forceps-assisted deliveries are associated with significantly more maternal trauma than vacuum-assisted ones. Neonatal outcomes are largely comparable. In properly indicated cases, OVD remains a safe and effective alternative to cesarean section and should be encouraged with adequate training and protocol adherence, especially in resource-limited settings.

Key-words: Operative vaginal delivery, Forceps, Vacuum extraction, Maternal morbidity, Neonatal outcomes, SNCU admission

INTRODUCTION

Operative vaginal delivery (OVD) refers to the use of obstetric forceps or vacuum extraction to assist the mother in delivering the fetus vaginally during the second stage of labor. Historically, such interventions were employed primarily to prevent maternal death in obstructed or prolonged labor.

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However, with advancements in maternal and neonatal care, the modern approach emphasizes the importance of achieving favorable outcomes for both the mother and the newborn [1,2].

In the current era, with the rising preference for cesarean section in complicated labor, the frequency of OVDs has declined in many tertiary centers, especially in urban India. This decline is attributed to concerns over neonatal morbidity, lack of clinical exposure and hands-on training among junior obstetricians, fear of litigation, and absence of institutional protocols [3]. Nonetheless, the World Health Organization (WHO) and other allied UN agencies recognize assisted vaginal delivery as one of the six critical functions of basic emergency obstetric care [4].

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In resource-constrained settings such as rural India, where timely access to cesarean section may not always be possible, OVD continues to play a vital role in preventing maternal exhaustion, obstructed labor, and stillbirth. When appropriately performed, it can safely expedite delivery and reduce both maternal and neonatal morbidity [5]. Proper training and case selection are key to minimizing complications.

The choice of instrument—vacuum or forceps—depends on fetal position, station, urgency, and the provider's expertise. Several studies suggest that vacuum delivery is associated with lower rates of maternal soft tissue injuries. At the same time, forceps offer better control in specific scenarios such as persistent occiput posterior position or when immediate delivery is warranted [6]. The skill of the operator and institutional readiness play a crucial role in outcomes [7].

In the Indian context, few studies have systematically compared maternal and neonatal outcomes following vacuum and forceps deliveries. Data on complications such as perineal tears, postpartum hemorrhage (PPH), cervical trauma, neonatal injuries, and special newborn care unit (SNCU) admissions remain sparse [8].

This hospital-based study was conducted in a tertiary care center in Odisha to evaluate and compare short-term maternal and neonatal outcomes associated with vacuum versus forceps-assisted deliveries. The findings aim to support safe clinical decision-making and revive confidence in the use of OVD in modern obstetric care.

MATERIALS AND METHODS

Study Design and Setting- This was a facility-based observational comparative study conducted over one year from October 2017 to September 2018 in a tertiary care hospital in Odisha, India.

Study Population- A total of 113 women who underwent operative vaginal deliveries (OVD) were included. All participants provided informed written consent. Inclusion criteria were term singleton pregnancies in cephalic presentation during second stage of labor. Exclusion criteria included malpresentations, multiple gestations, preterm deliveries, fetal anomalies, and cephalopelvic disproportion.

Group Allocation- Eligible women were randomized into two groups:

- Vacuum-assisted delivery group (n = 83)
- Forceps-assisted delivery group (n = 30)

Procedure Details- Vacuum extraction was performed using a silastic cup placed accurately over the fetal head's flexion point. Forceps-assisted deliveries were conducted using short curved Wrigley's outlet forceps. Experienced obstetricians did all procedures as per institutional guidelines. Traction during delivery was synchronized with uterine contractions and maternal pushing.

Maternal Outcome Measures- Maternal parameters assessed included extension of episiotomy, degree of perineal and cervical tears, incidence of postpartum hemorrhage (PPH), wound dehiscence, urinary retention, puerperal fever, total hospital stay duration, and discharge status.

Neonatal Outcome Measures- Neonatal parameters included Apgar score at 1-minute, spontaneous cry, initiation of breastfeeding, instrument-related external injuries, SNCU admission, duration of SNCU stay, and final discharge status.

Statistical Analysis- Data was analyzed using Chi-square test and Fisher's exact test, where applicable. A $p<0.05$ was considered statistically significant.

RESULTS

A total of 113 women underwent operative vaginal deliveries, out of which 83 (73.5%) were vacuum-assisted and 30 (26.5%) forceps-assisted. Most women belonged to the age group of 21–30 years (82.3%), with a higher proportion of primigravida patients (77.9%). Vacuum deliveries were more common among younger and nulliparous women (Table 1).

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Table 1: Demographic Distribution of Study Participants

Variable	Vacuum (n=83)	Forceps (n=30)	Total (N=113)	*p*-value
Age 18–20 yrs	16 (19.2%)	2 (6.6%)	18 (15.9%)	0.0242
Age 21–30 yrs	68 (81.9%)	25 (83.3%)	93 (82.3%)	NS
Primigravida	66 (79.5%)	22 (73.3%)	88 (77.9%)	NS
Multigravida	17 (20.5%)	8 (26.6%)	25 (22.1%)	–

The most frequent indication for operative vaginal delivery in both groups was prolonged second stage of labor (51.3%), followed by non-reassuring fetal heart rate (32.7%) and maternal exhaustion (15.9%). These proportions were nearly similar between vacuum and forceps groups, indicating uniformity in selection criteria (Table 2).

Table 2: Indications for Operative Vaginal Delivery

Indication	Vacuum (n=83)	Forceps (n=30)	Total (N=113)
Prolonged 2nd stage	42 (50.6%)	16 (53.3%)	58 (51.3%)
Non-reassuring FHR	28 (33.7%)	9 (30.0%)	37 (32.7%)
Maternal exhaustion	13 (15.6%)	5 (16.7%)	18 (15.9%)

Maternal morbidity was notably higher in the forceps group. Incidence of perineal tears (56.7% vs. 19.3%, p = 0.0007), cervical tears (23.3% vs. 2.4%, p = 0.0012), and PPH (43.3% vs. 10.8%, p = 0.001) were significantly greater among forceps-assisted deliveries. Additionally, extended hospital stay beyond 3 days and unsatisfactory discharge rates were more frequent with forceps (Table 3). These findings indicate higher soft tissue trauma and postpartum complications associated with forceps use.

Table 3: Maternal Morbidities in Operative Vaginal Deliveries

Complication	Vacuum (n=83)	Forceps (n=30)	*p*-value	Significance
Extension of episiotomy	16 (19.3%)	12 (40%)	0.0242	Significant
Perineal tear (any degree)	16 (19.3%)	17 (56.7%)	0.0007	Significant
Cervical tear	2 (2.4%)	7 (23.3%)	0.0012	Significant
PPH	9 (10.8%)	13 (43.3%)	0.001	Significant
Wound dehiscence	0	1 (3.3%)	–	–
Urinary retention	2 (2.4%)	2 (6.7%)	0.6136	Not significant
Fever	5 (6%)	4 (13.3%)	0.2051	Not significant
Hospital stay >3 days	27 (32.5%)	19 (63.3%)	0.0032	Significant
Satisfactory discharge	81 (97.5%)	23 (79.3%)	0.001	Significant

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Neonatal parameters such as spontaneous cry after birth, APGAR scores <6 at 1 minute, and early initiation of breastfeeding did not show significant variation between groups. External injury rates were slightly higher with vacuum (8.4%) compared to forceps (10.7%), though this was not statistically significant (Table 4). Most neonates recovered well and were discharged satisfactorily in both groups.

Table 4: Neonatal Outcomes After Operative Vaginal Delivery

Neonatal Parameter	Vacuum (n=83)	Forceps (n=30)	*p*-value	Significance
Spontaneous cry at birth	76 (91.6%)	25 (83.3%)	0.21	NS
Apgar score <6 at 1 minute	11 (13.3%)	6 (20%)	0.3829	NS
Early breastfeeding (<30 min)	66 (79.5%)	20 (66.7%)	0.2466	NS
External injury (any)	7 (8.4%)	3 (10.7%)	–	–

SNCU admissions were significantly higher in the forceps group (41.4%) compared to vacuum (21.3%) ($p = 0.0356$), though mean duration of SNCU stay and final neonatal outcomes were similar. This suggests initial adaptation difficulties may be more common in forceps-delivered neonates, but long-term outcomes remain comparable (Table 5, Fig. 1).

Table 5: SNCU Admission and Neonatal Outcomes

Outcome	Vacuum (n=83)	Forceps (n=30)	*p*-value	Significance
SNCU Admission	17 (21.3%)	12 (41.4%)	0.0356	Significant
Mean SNCU stay >3 days	4 (4.8%)	3 (10%)	–	–
Satisfactory final discharge	79 (95.2%)	26 (86.7%)	0.1192	Not significant

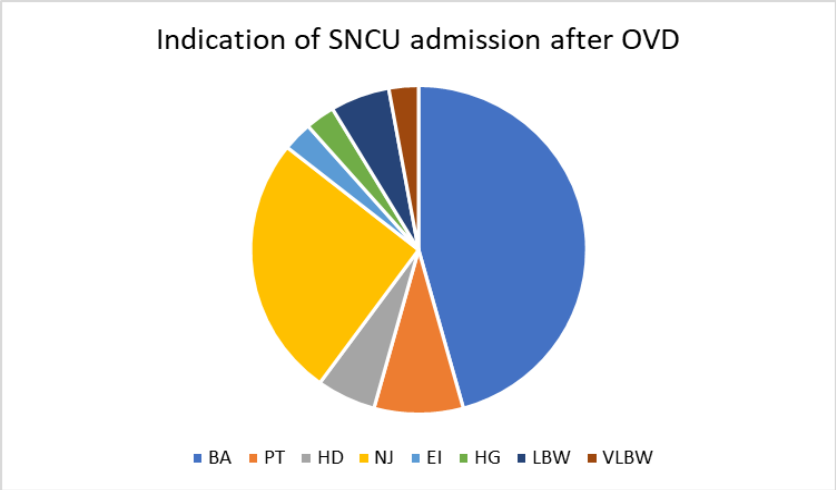

Fig. 1: Comparison of SNCU Admissions in Vacuum vs Forceps Deliveries

DISCUSSION

This study presents a comparative evaluation of maternal and neonatal outcomes in vacuum versus forceps-assisted operative vaginal deliveries (OVDs) in a tertiary care setting in Eastern India. The findings reaffirm the global trend that vacuum delivery, when used with proper technique and indications, is associated with fewer maternal complications and comparable neonatal safety relative to forceps.

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In terms of maternal outcomes, significantly higher rates of perineal tears, episiotomy extension, cervical injuries, and postpartum hemorrhage (PPH) were observed among women delivered by forceps. These findings are consistent with international studies [9,10], where mechanical stretching and direct blade pressure during forceps application are well-documented to cause soft tissue trauma. In our cohort, more than half of the forceps cases (56.7%) experienced perineal tears versus only 19.3% in the vacuum group, underscoring the less invasive nature of vacuum delivery [11].

Cervical injuries, often a neglected complication in OVDs, were also significantly higher with forceps (23.3%), possibly due to rotational malalignments during application. Similar findings were reported by Arulkumaran [12], who emphasized that poor skill and suboptimal fetal positioning are major contributors to maternal injury. Furthermore, longer hospital stays and reduced maternal satisfaction in the forceps group reflect the post-delivery impact of these injuries, not only medically, but also psychologically.

The neonatal outcomes in our study align with multiple global trials that found no statistically significant differences in Apgar scores or early initiation of breastfeeding between the two OVD modalities [13,14]. However, a key finding was the higher rate of SNCU admissions among forceps-assisted neonates (41.4%) compared to vacuum (21.3%), a difference that reached statistical significance. These admissions were often precautionary rather than due to severe pathology, and most neonates were discharged in good health.

International data, such as from the WHO multicentric survey and the Canadian Perinatal Surveillance System, also report higher immediate postnatal monitoring needs following forceps use, possibly due to transient neurologic depression or facial bruising [15,16]. Nonetheless, the similarity in final discharge status in our study reinforces that while forceps may provoke concern at birth, long-term neonatal outcomes remain unaffected in most cases.

The analysis of SNCU admission indications showed that birth asphyxia and neonatal jaundice were the leading causes. These findings reflect that many complications requiring neonatal care were metabolic or functional rather than structural, which often resolve with timely intervention and observation. Previous studies also suggest that vacuum delivery, despite minor scalp injuries like cephalohematoma, leads to less deep tissue trauma than forceps [17].

A systematic review by Bofill et al. noted that while both OVD types are safe when conducted correctly, vacuum is preferred in settings where maternal soft tissue integrity and minimal intervention are priorities [18]. Forceps may still be beneficial in cases requiring precise rotation or when rapid delivery is necessary, such as in late second stage fetal distress [19].

Skill of the obstetrician remains central to success. A WHO technical consultation emphasized that the use of OVDs should not be judged solely by mode, but by appropriateness of indication and operator competence [20]. Hence, periodic skill-based workshops and audits are vital, especially in overburdened tertiary care centres of economically poorer states with high waiting time for Caesarean section and also with poor maternal nutritional and hygiene status leading to unfavorable post-operative recovery following Caesarean section.

Our study suggests that vacuum extraction offers safer maternal outcomes with equivalent neonatal safety in most cases. However, forceps remain a critical tool in emergencies. Balanced training, careful case selection, and adherence to standardized protocols can reduce complications and improve outcomes in both forms of operative vaginal delivery.

LIMITATIONS

This was a single-center, observational study with a relatively small sample size, which may limit generalizability. Long-term neonatal outcomes and maternal psychological impact were not assessed. Operator skill variability was not standardized, which could have influenced complication rates across groups.

CONCLUSIONS

Vacuum-assisted vaginal delivery showed significantly lower maternal complications such as perineal tears, cervical injuries, and postpartum hemorrhage, compared to forceps. Neonatal outcomes were largely comparable between the two groups, though forceps delivery was associated with higher SNCU admissions, mostly for transient conditions. Proper training, timely decision-making, and operator experience are crucial to optimize outcomes in operative vaginal delivery. Vacuum extraction may be preferred when maternal tissue preservation is a priority, while forceps remain valuable

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in urgent, low-station deliveries. Future research should focus on long-term neonatal outcomes and integrating simulation-based OVD training into obstetric education to ensure safer practices.

CONTRIBUTION OF AUTHORS

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