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CLINICAL STUDY OF MATERNAL & PERINATAL OUTCOME IN INSTRUMENTAL VAGINAL DELIVERY

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ABSTRACT Instrumental vaginal delivery remains an important obstetric intervention for shortening the second stage of labour and avoiding unnecessary second-stage cesarean section. However, its use is declining because of medicolegal concerns, reduced training exposure, and fear of maternal and neonatal complications. This study evaluated maternal and perinatal outcomes following vacuum-assisted and forceps-assisted vaginal delivery in a tertiary care hospital. This prospective observational study was conducted in the Department of Obstetrics and Gynecology, Shri Bhausaheb Hire Government Medical College, Maharashtra, India, from January 2024 to December 2025. During the study period, 10,092 deliveries were conducted, of which 6,432 were vaginal deliveries. A total of 176 instrumental vaginal deliveries were included, giving an incidence of 2.73% among vaginal deliveries and 1.74% among total deliveries. Vacuum-assisted delivery was performed in 122 cases (69.32%) and forceps delivery in 54 cases (30.68%). The commonest indication was prolonged second stage of labour (46.59%), followed by fetal distress (32.95%). Fetal distress was significantly more common in the forceps group (53.70%) than the vacuum group (23.77%) (p=0.001). Maternal morbidity was higher with forceps delivery, including episiotomy extension (20.37% vs 6.56%, p=0.012), perineal tears (18.52% vs 5.74%, p=0.018), and vaginal wall tears (9.26% vs 1.64%, p=0.027). NICU admission was required in 21 neonates (11.93%). No maternal or neonatal mortality was observed. Instrumental vaginal delivery remains a safe and effective obstetric procedure when performed with proper patient selection, skilled supervision, and adherence to standard prerequisites.

KEYWORDS : Instrumental Vaginal Delivery, Vacuum Extraction, Forceps Delivery, Maternal Outcome, Neonatal Outcome, Operative Vaginal Delivery

INTRODUCTION

Instrumental vaginal delivery remains an important component of modern obstetric practice and plays a significant role in reducing maternal and neonatal morbidity associated with prolonged second stage of labor and unnecessary cesarean section. Operative vaginal delivery includes vacuum-assisted vaginal delivery and forceps-assisted vaginal delivery performed under appropriate obstetric indications to facilitate safe vaginal birth.[1]

Despite advances in obstetric care and increasing cesarean section rates worldwide, operative vaginal delivery continues to remain an essential obstetric skill, particularly in tertiary care referral centers managing high-risk pregnancies.[2] However, a declining trend in instrumental vaginal delivery has been observed globally and in India because of medicolegal concerns, fear of maternal and neonatal complications, declining training exposure, and increasing preference for cesarean section.[3]

Vacuum extraction and forceps delivery each have specific advantages and limitations. Vacuum-assisted vaginal delivery is generally associated with lower maternal soft tissue trauma and easier application, whereas forceps delivery provides rapid fetal extraction in situations such as fetal distress.[4] However, both procedures are associated with potential maternal and neonatal complications including episiotomy extension, perineal tears, postpartum hemorrhage, scalp injuries, cephalhematoma, facial injuries, and birth asphyxia.[5] Therefore, the present prospective observational study was undertaken to evaluate maternal and perinatal outcomes associated with instrumental vaginal delivery.

MATERIAL AND METHODS

The present study was a prospective observational study conducted in the Department of Obstetrics and Gynecology at Shri Bhausaheb Hire Government Medical College, Maharashtra, India, over a period of two years from January 2024 to December 2025. Written informed consent was obtained from all participants prior to inclusion in the study. Institutional Ethics Committee approval was obtained before commencement of the study.

Inclusion Criteria

- Singleton pregnancy
- Cephalic presentation
- Gestational age ≥37 weeks
- Fully dilated cervix
- Women undergoing vacuum-assisted or forceps delivery
- Women willing to participate in the study

Exclusion Criteria

- Multiple pregnancy
- Malpresentation
- Intrauterine fetal demise
- Preterm delivery
- Known cephalopelvic disproportion
- Previous cesarean section with contraindication to vaginal delivery

Detailed maternal demographic characteristics, obstetric history, labor details, indication for operative vaginal delivery, type of instrument used, and maternal and neonatal outcomes were recorded using a predesigned structured proforma. General physical examination, systemic examination, and detailed obstetric examination findings were noted. Labor was monitored according to standard institutional labor room protocols. The decision regarding instrumental vaginal delivery and choice of instrument was made by the attending obstetrician depending upon fetal condition, station and position of the fetal head, maternal condition, and clinical judgment.

Prerequisites for operative vaginal delivery including fully dilated cervix, ruptured membranes, engaged fetal head, known fetal position, adequate maternal pelvis, empty urinary bladder, and adequate analgesia were confirmed before application of instrument. Vacuum-assisted vaginal delivery was performed using silastic vacuum cups under standard aseptic precautions, whereas forceps delivery was conducted using Wrigley's outlet forceps according to institutional protocol and standard obstetric guidelines.

Maternal outcome variables studied were indications for instrumental vaginal delivery, episiotomy extension, perineal tears, cervical tears, vaginal wall tears, postpartum hemorrhage, and requirement of blood transfusion. Neonatal outcome variables included APGAR score at 5 minutes, scalp injuries, cephalhematoma, facial injuries, birth asphyxia, neonatal jaundice, and NICU admission. There were no maternal or neonatal deaths in the present study.

Data were entered into Microsoft Excel spreadsheet and analyzed using SPSS software version 24. Qualitative variables were expressed as frequency and percentage, whereas quantitative variables were expressed as mean ± standard deviation. Chi-square test and Fisher exact test were used for comparison of categorical variables, and Student's t-test was applied for continuous variables wherever appropriate. A p-value of less than 0.05 was considered statistically significant.

RESULTS

During the study period, a total of 10,092 deliveries were conducted at the institution, of which 6,432 were vaginal deliveries. A total of 176 instrumental vaginal deliveries were included in the study, giving an incidence of 2.73% among vaginal deliveries and 1.74% among total deliveries. Among the instrumental vaginal deliveries, vacuum-

assisted vaginal delivery was performed in 122 (69.32%) cases, whereas forceps delivery was performed in 54 (30.68%) cases.

The majority of women belonged to the age group of 20–25 years accounting for 54.55% cases. The mean maternal age in the present study was 24.8±3.7 years. Primigravidae constituted 67.05% of the study population, whereas multigravidae accounted for 32.95% cases. Most instrumental vaginal deliveries were conducted between 37 and 40 weeks of gestation accounting for 86.93% cases.

Table 1: Maternal Demographic Characteristics

Characteristics	Vacuum (n=122)	Forceps (n=54)	Total	p-value
Mean maternal age (years)	24.6±3.4	25.1±3.9	24.8±3.7	P>0.05
Primigravida	79 (64.75%)	39 (72.22%)	118 (67.05%)	P>0.05
Multigravida	43 (35.25%)	15 (27.78%)	58 (32.95%)	P>0.05
Gestational age 37–40 weeks	104 (85.25%)	49 (90.74%)	153 (86.93%)	P>0.05

Prolonged second stage of labor was the most common indication for instrumental vaginal delivery accounting for 46.59% cases, followed by fetal distress in 32.95% cases. Maternal exhaustion was observed in 10.80% women, hypertensive disorders in 5.11%, and poor maternal bearing down efforts in 4.55% cases. Fetal distress was significantly more common in the forceps group (53.70%) compared to the vacuum-assisted delivery group (23.77%) (p=0.001).

Table 2: Indications for Instrumental Vaginal Delivery

Indications	Vacuum (n=122)	Forceps (n=54)	Total	p-value
Prolonged second stage	61 (50.00%)	21 (38.89%)	82 (46.59%)	P>0.05
Fetal distress	29 (23.77%)	29 (53.70%)	58 (32.95%)	0.001
Maternal exhaustion	15 (12.30%)	4 (7.41%)	19 (10.80%)	P>0.05
Hypertensive disorders	8 (6.56%)	1 (1.85%)	9 (5.11%)	P>0.05
Poor maternal bearing down efforts	9 (7.38%)	1 (1.85%)	8 (4.55%)	P>0.05

Maternal morbidity was observed more frequently in forceps-assisted vaginal delivery compared with vacuum-assisted vaginal delivery. Episiotomy extension was observed in 20.37% women in the forceps group compared to 6.56% women in the vacuum group (p=0.012). Perineal tears were also significantly higher in the forceps group (18.52%) compared with the vacuum-assisted delivery group (5.74%) (p=0.018).

Vaginal wall tears were significantly more common in forceps-assisted vaginal delivery (9.26%) compared with vacuum-assisted delivery (1.64%) (p=0.027). Postpartum hemorrhage was observed in 6.25% cases overall and requirement of blood transfusion was noted in 2.27% women. However, these differences between the two groups were statistically non-significant.

Table 3: Maternal Morbidity Following Instrumental Vaginal Delivery

Maternal Morbidity	Vacuum (n=122)	Forceps (n=54)	p-value
Episiotomy extension	8 (6.56%)	11 (20.37%)	0.012
Perineal tears	7 (5.74%)	10 (18.52%)	0.018
Cervical tears	3 (2.46%)	4 (7.41%)	P>0.05
Vaginal wall tears	2 (1.64%)	5 (9.26%)	0.027
Postpartum hemorrhage	6 (4.92%)	5 (9.26%)	P>0.05
Blood transfusion required	2 (1.64%)	2 (3.70%)	P>0.05

Facial injuries were significantly more common following forceps delivery 4.10% compared to vacuum-assisted delivery (0.82%) (p=0.019). Cephalhematoma was noted in 7.38% neonates in the vacuum group and 1.85% neonates in the forceps group. Birth asphyxia was observed in 5.11% neonates overall, whereas neonatal jaundice was noted in 5.11% cases.

NICU admission was required in 21 (11.93%) neonates, including 10.66% neonates in the vacuum-assisted delivery group and 14.81% neonates in the forceps delivery group. The most common indications for NICU admission were respiratory distress, meconium aspiration syndrome, and birth asphyxia. No neonatal mortality was observed in the present study.

Table 4: Neonatal Morbidity Following Instrumental Vaginal Delivery

Neonatal Morbidity	Vacuum (n=122)	Forceps (n=54)	p-value
Scalp injury	5 (4.10%)	2 (3.70%)	P>0.05
Cephalhematoma	9 (7.38%)	1 (1.85%)	P>0.05
Facial injury	1 (0.82%)	4 (7.41%)	0.019
Birth asphyxia	5 (4.10%)	4 (7.41%)	P>0.05
Neonatal jaundice	6 (4.92%)	3 (5.56%)	P>0.05
NICU admission	13 (10.66%)	8 (14.81%)	P>0.05

Low APGAR score at 5 minutes was observed in 15 (8.52%) neonates. However, there was no statistically significant difference between vacuum-assisted and forceps delivery groups.

Table 5: APGAR Score at 5 Minutes

APGAR Score	Vacuum (n=122)	Forceps (n=54)	Total	p-value
<7	9 (7.38%)	6 (11.11%)	15 (8.52%)	P>0.05
≥7	113 (92.62%)	48 (88.89%)	161 (91.48%)	P>0.05

DISCUSSION

Instrumental vaginal delivery remains an important component of modern obstetric practice and plays a significant role in reducing second-stage cesarean section and associated maternal morbidity. In the present study, the incidence of instrumental vaginal delivery was 2.73% among vaginal deliveries and 1.74% among total deliveries. The declining trend in operative vaginal delivery observed globally may be attributed to increasing cesarean section rates, medicolegal concerns, reduced training exposure, and fear of maternal and neonatal complications.[6,7,8]

The mean maternal age in the present study was 24.8±3.7 years, and majority of women belonged to the age group of 20–25 years accounting for 54.55% cases. Similar findings were reported by Sonawane et al.,[9] and Chaudhari et al.,[12] who observed that operative vaginal delivery was more common among younger women in the reproductive age group. This may be explained by the predominance of primigravidae and increased incidence of prolonged second stage among younger women.

Primigravidae constituted 67.05% of cases in the present study. Comparable findings were reported by Faisal et al.,[2] Sonawane et al.,[9] and Sharma et al.,[5] where primigravid women formed the majority of operative vaginal deliveries. Primigravid women are more likely to require instrumental vaginal delivery because of prolonged labor, maternal exhaustion, delayed fetal descent, and relatively inefficient maternal expulsive efforts.

In the present study, prolonged second stage of labor was the most common indication for instrumental vaginal delivery accounting for 46.59% cases, followed by fetal distress in 32.95% cases. Similar findings were reported by Sonawane et al.,[9] and Sharma et al.,[5] where prolonged second stage constituted the predominant indication for operative vaginal delivery. However, Faisal et al. reported fetal distress as a major indication for forceps-assisted delivery because of the shorter decision-to-delivery interval associated with forceps application.[2] In the present study also, forceps delivery was significantly more common in cases of fetal distress (53.70%) compared to vacuum-assisted delivery (23.77%) (p=0.001). This finding supports the continued role of forceps delivery in situations requiring rapid fetal extraction.

Vacuum-assisted vaginal delivery accounted for 69.32% cases in the present study, whereas forceps delivery accounted for 30.68% cases. Similar preference toward vacuum extraction has been reported in recent Indian and international studies.[2,6,9] Vacuum extraction is generally preferred because of easier application, lower analgesia requirement, reduced maternal soft tissue trauma, and shorter learning curve. The Royal College of Obstetricians and Gynaecologists and American College of Obstetricians and Gynecologists also recommend selective use of vacuum extraction in appropriately selected patients.[1,8]

Maternal morbidity was comparatively higher in the forceps group in the present study. Episiotomy extension was observed in 20.37% women undergoing forceps delivery compared to 6.56% women

undergoing vacuum-assisted delivery (p=0.012). Similarly, perineal tears were significantly more common in forceps delivery (18.52%) compared with vacuum extraction (5.74%) (p=0.018). Comparable findings were reported by Sonawane et al.,[9] O'Mahony et al.,[10] and Johanson et al.,[11] who demonstrated increased maternal soft tissue trauma associated with forceps-assisted delivery. Increased genital tract trauma associated with forceps delivery may be attributed to larger instrument size, greater traction force, and increased tissue compression during extraction.

Vaginal wall tears were also significantly more common in forceps-assisted vaginal delivery (9.26%) compared to vacuum-assisted delivery (1.64%) (p=0.027). Similar findings have been documented in Cochrane reviews and Indian tertiary care studies evaluating maternal morbidity associated with operative vaginal delivery.[10] Forceps delivery has consistently been associated with increased risk of maternal birth canal trauma and anal sphincter injury.

Postpartum hemorrhage was observed in 6.25% cases in the present study, with no statistically significant difference between vacuum-assisted and forceps delivery groups. Comparable Maharashtra-specific evidence regarding postpartum hemorrhage following instrumental vaginal delivery was limited. However, Indian tertiary care studies have reported relatively low incidence of severe postpartum hemorrhage when operative vaginal delivery is performed under standardized institutional protocols with proper patient selection.[5]

Neonatal morbidity was comparable between both groups in the present study. Scalp injuries were more common following vacuum-assisted delivery (4.1%) compared to forceps delivery (3.70%), whereas cephalhematoma was observed in 7.38% neonates delivered by vacuum extraction. Similar findings were reported by Johanson et al.,[10] and O'Mahony et al.,[11] who observed increased scalp trauma and cephalhematoma associated with vacuum extraction due to traction transmitted through the vacuum cup.

Facial injuries were significantly more common following forceps delivery (7.41%) compared to vacuum-assisted delivery (0.82%) (p=0.019). Similar findings were reported in studies comparing forceps and vacuum extraction, where forceps delivery demonstrated increased facial abrasions and nerve injuries because of direct compression by the forceps blades.[11]

Low APGAR score at 5 minutes was observed in 8.52% neonates in the present study, with no statistically significant difference between vacuum-assisted and forceps delivery groups. Similar findings were reported by Sharma et al.,[5] and Faisal et al.,[2] who observed comparable neonatal outcomes between both instruments when used appropriately. Variations in APGAR score across studies may be related to differences in fetal distress prevalence, referral bias, operator expertise, neonatal resuscitation practices, and institutional NICU admission criteria.

NICU admission was required in 11.93% neonates in the present study. The most common indications for NICU admission were respiratory distress, meconium aspiration syndrome, and birth asphyxia. Comparable NICU admission rates were reported in Indian tertiary care studies evaluating operative vaginal delivery.[2,5] Differences in NICU admission rates across studies may reflect variation in referral load, institutional neonatal admission policies, and proportion of high-risk pregnancies managed at tertiary care centers.

No maternal or neonatal mortality was observed in the present study. Overall, the present study demonstrated that maternal morbidity was comparatively higher in forceps-assisted vaginal delivery because of increased genital tract trauma, whereas neonatal scalp complications were more commonly associated with vacuum-assisted vaginal delivery. Nevertheless, serious maternal and neonatal complications remained low in both groups, indicating that instrumental vaginal delivery remains a safe and effective obstetric intervention when performed by skilled obstetricians with proper patient selection and strict adherence to standard obstetric prerequisites.

CONCLUSION

Instrumental vaginal delivery remains a safe and effective obstetric intervention when performed with appropriate patient selection, adequate operator expertise, and strict adherence to standard obstetric prerequisites. Forceps-assisted vaginal delivery, although associated with increased maternal morbidity such as episiotomy extension and perineal tears, remained particularly useful in cases requiring rapid fetal extraction, especially fetal distress.

The present study highlights the continued importance of operative vaginal delivery in modern obstetric practice and emphasizes the need for regular training and maintenance of instrumental delivery skills among obstetricians in tertiary care teaching hospitals.

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