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RESEARCH ARTICLE

Comparison of Maternal and Fetal Outcomes of Operative Vaginal Deliveries Using Vacuum and Forceps in a Tertiary Hospital

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ABSTRACT

Objective: There is limited knowledge regarding operative vaginal delivery. This study aimed to assess the indications, complications, and maternal and neonatal outcomes of operative vaginal delivery utilizing forceps and vacuum extraction at a tertiary hospital.

Materials and Methods: This retrospective analysis included a total of 117 individuals who had undergone operative vaginal delivery at University of Health Sciences Istanbul Kanuni Sultan Süleyman Training and Research Hospital between January 1, 2016, and December 31, 2022. The participants were classified into forceps and vacuum extraction groups. Maternal and neonatal outcomes related to demographic characteristics (mean age, parity, BMI) postpartum hemorrhage, perineal lacerations, cervical tears, anal sphincter damage, length of stay, the necessity for neonatal intensive care, the incidence of infant jaundice, cephalohematomas, brachial plexus injuries, and Apgar scores were analyzed.

Results: The study included 117 patients, 35 of whom had forceps deliveries and 82 vacuum deliveries. The rate of operative vaginal delivery was 0.35%. Apgar scores at both the first and fifth minute were significantly lower in the forceps group p=0.001 The necessity for newborn intensive care, and the occurrence of brachial plexus injury were significantly higher in the forceps group p=0.001 The occurrence of cervical tears was higher in the vacuum group p=0.001.

Conclusion: Our study has displayed the superiority of vacuum over forceps. In carefully selected circumstances, vacuums are associated with relatively low rates of serious morbidity and mortality in both mother and baby compared to forceps.

Keywords: Forceps, operative vaginal delivery, vacuum

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INTRODUCTION

Operative vaginal delivery is a medical procedure that involves using instruments to safely extract the fetus from the vagina in the presence of maternal and fetal indications. The device might be either a vacuum or forceps.[1] The reasons for performing an operative vaginal delivery include a prolonged second stage of labor, fetal distress or the possibility of fetal distress, and shortening the second stage of labor to assist the mother.[2] The prevalence of operative vaginal delivery (OVD) showed significant variation across Europe in 2010, ranging from 0.5% to 16.4%. In the USA, the rate was 3.3% in 2013.[3,4] There has been an increasing tendency for cesarean delivery in recent years.[5,6] Multiple strategies have been suggested to address the rising rates of cesarean sections (CS). These include adopting a more natural approach to labor and delivery that aligns with the body's normal processes, providing individualized midwifery assistance during labor, and implementing updated guidelines for actively managing the labor process.[7] Recent research has indicated that fetal injuries, specifically skull fractures, are more probable when a cesarean section is attempted instead of an operative vaginal delivery, particularly when the fetal head is deeply positioned in the maternal pelvis.[8] Operative vaginal delivery is a crucial technique for reducing the necessity of a primary cesarean delivery.[9]

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OVD has a low rate of morbidity in carefully selected circumstances[10] while a failing OVD can pose substantial risks to both the mother and the infant.[11] There is limited knowledge regarding operative vaginal delivery.

This study aimed to assess the indications, complications, and maternal and neonatal outcomes of operative vaginal delivery using forceps and vacuum at a tertiary hospital.

MATERIALS and METHODS

This retrospective analysis included a total of 117 individuals who had undergone operative vaginal delivery in University of Health Sciences Istanbul Kanuni Sultan Süleyman Training and Research Hospital between January 1, 2016, and December 31, 2022. The participants were classified into forceps and vacuum groups. The study compared and contrasted different demographic and clinical factors, such as the average age, number of children, postpartum hemoglobin drop after vaginal delivery, and maternal outcomes like blood loss, perineal lacerations, cervical tears, anal sphincter damage, and length of stay in the hospital after giving operative vaginal delivery. We considered neonatal factors including fetal weight, blood pH, neonatal intensive care unit admission, neonatal jaundice, cephalohematomas, brachial plexus injuries, and Apgar scores at first and fifth minutes post-operative vaginal delivery. Test results were subsequently compared among the groups.

Operative Vaginal Delivery Technique

The technique used for operative vaginal delivery involved the use of soft silicon heads with diameters of 40, 50, and 60 mm. A pressure of 0.6 kg/cm^2 was administered during the vacuum delivery. During the application process, the bell was situated around 3cm anterior to the posterior fontanel, superior to the sagittal suture. We ensured with utmost precision that no maternal tissue was placed beneath the bell. A force was applied in a certain direction without rotation or pivoting. The application was attempted thrice, with each effort limited to 20 minutes. Simpson forceps were employed to facilitate forceps delivery. The choice of procedure, including the selection of forceps or vacuum cups, is a topic that warrants thoughtful discussion and consideration.[12] The instrument type was selected based on the patient's pelvic examination results and the physician's preference. At our clinic, consultant obstetricians and specialists who have completed at least five years of post-graduate training typically used operative vaginal delivery. Episiotomy was performed on nearly all of the patients.

Criteria for Inclusion

The study comprised women between the ages of 18 and 49 who experienced an extended second stage of labor, fetal distress, or the potential for fetal distress. These women underwent an operative vaginal delivery using forceps or a vacuum to expedite the second stage of labor and benefit the mother. The study only included cases where the baby was alive at full term, had a single birth, had a head-first position, and had complete medical records available.

Criteria for Exclusion

The study excluded patients with incomplete medical data as well as those who had multiple pregnancies, in-utero fetal deaths, or preterm birth.

Informed Consent

Given that the research was carried out retrospectively, patient consent was not necessary for their involvement in the study or publication of the findings. Nevertheless, before undergoing operative vaginal delivery, all patients duly provided signed and informed permission.

Ethics Committee Approval

The study obtained approval from the ethical committee of the Kanuni Sultan Suleyman Training and Research Hospital in compliance with the 2013 amendment of the Declaration of Helsinki. The approval was granted under the application number KAEK /2023.09.126 (21.09.2023).

Statistical Analysis

The data analysis was performed utilizing SPSS for Windows 24 (SPSS Inc., Chicago, IL). Numerical and percentage values were used to present categorical measurements, while the mean and standard deviation were employed to summarize continuous measurements. The chi-square test statistic was employed to compare categorical variables, while the t-test statistic was utilized to evaluate continuous data among independent groups. The predetermined level of significance was established at 0.05.

RESULTS

Figure 1 displays the precise number of participants included in the study. In the forceps group, the initial cohort consisted of 38 individuals, of which 35 were theoretically eligible. Out of the participants in the vacuum group, 86 met the criteria for eligibility, but only 82 were considered possibly acceptable for the study. Four individuals were eliminated from the study due to incomplete data. In this retrospective analysis, a total of 117 patients who received forceps and vacuum for operative

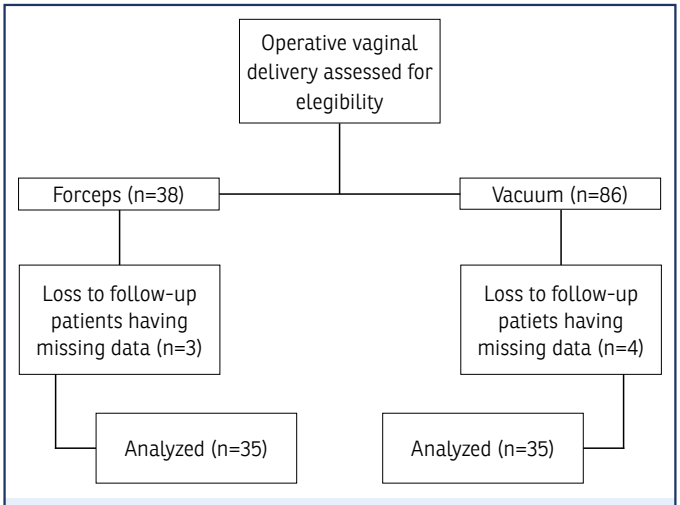

Figure 1. A flow chart illustrating the patients who underwent operative vaginal delivery

vaginal delivery in a tertiary hospital were included. Our hospital conducted a total of 33,450 vaginal delivery from January 2016 to December 2022. Out of all the deliveries, 117 of them were operative vaginal delivery, accounting for 0.35% of the total. Table 1 presents an examination of demographic data and clinical characteristics. The average mother age in the forceps group was 25.01±4.61 years, while in the vacuum group, was 26.08±3.82 years. Nulliparous women accounted for 74.28% of forceps delivery and 82.92% of vacuum delivery. No notable disparity was observed between the two groups regarding the average age, hematocrit levels, gestational week, and nulliparity. Table 2 displays the indications for operative vaginal delivery. The predominant indication in both groups was the expansion of the second stage. There was no difference between the two groups regarding the indications for surgical delivery. Table 3 displays the outcomes related to newborns. No notable disparity was observed between the two groups for the average weight of newborns, blood acidity levels in the fetus, cranial bleeding, neonatal jaundice of the skin, or damage to the nerves in the upper limb region. The initial Apgar score below five at the first minute was 6 (17.14%) in the forceps group and 7 (8.53%) in the vacuum group, with a statistically significant difference (p=0.001). The results were statistically significant. At the 5th minute, the Apgar score in the forceps group was 4, corresponding to 11.42% of the total. The vacuum group, achieving an Apgar score of 4, accounted for just 4.87% of the total. The difference in scores between the two groups is statistically significant, with a p-value of 0.001. The results were statistically significant. The incidence of newborn intensive care was 11 (31.42%) in the forceps group and 9 (10.97%) in the vacuum group, with a statistically significant difference (p=0.001). The results were statistically

Table 1. Demographic data and clinical features

	Forceps (n=35) mean±SD	Vacuum (n=82) mean±SD	p
Age	25.01±4.61	26.08±3.82	0.591
BMI (kg/m^2)	26.02±3.24	26.34±2.44	0.453
Hematocrit before delivery	37.42±2.24	37.66±1.36	0.656
Hematocrit after delivery	33.34±3.25	32.42±2.65	0.398
Gestation week	38.2±1.11	38.3±2.17	0.664
Nulliparity, n (%)	26 (74.28)	68 (82.92)	0.703

SD: Standard deviation; BMI: Body mass index

Table 2. Indications

	Forceps		Vacuum		p
	n	%	n	%	
Extension of the 2nd stage of labor	22	62.85	50	60.97	0.345
Fetal distress	4	11.42	10	12.19	0.805
Maternal heart disease	2	5.71	6	17.14	0.089
Maternal fatigue	7	20.00	16	19.51	0.515

Table 4. Maternal results

	Forceps mean±SD		Vacuum mean±SD		p
	n	%	n	%	
Episiotomy	33	94.28	78	95.12	0.821
Transfusion after delivery	2	5.71	5	6.09	0.237
Vaginal laceration	5	14.28	12	0.20	0.761
Postpartum hemorrhage	2	5.71	5	6.049	0.469
Cervical tear	5	14.28	25	30.48	0.001*
Sphincter damage	7	20.00	6	7.31	0.001*
Post-operative hospital stay (day)	2.15±0.32		2.12±0.40		0.486

*: Statistically different, mean±SD. SD: Standard deviation

Table 3. Neonatal results

	Forceps mean±SD		Vacuum mean±SD		p
	n	%	n	%	
Fetal birth weight (gram)	3545.2±243		3636.5±277		0.232
Fetal blood pH (mean±SD)	7.26±0.08		7.18±0.18		0.157
Requirement of neonatal intensive care	11	31.42	9	10.97	0.001*
Cephalohematoma	1	2.85	4	4.87	0.067
Injury of brachial plexus	2	5.71	1	12.21	0.001*
Neonatal jaundice	3	8.57	8	9.75	0.241
1st minute apgar<5	6	17.14	7	8.53	0.001*
5th minute apgar<7	4	11.42	4	4.87	0.001*
Fetal blood pH<7.05	4	11.42	4	4.87	0.001*

*: Statistically different, mean±SD. SD: Standard deviation

significant. The fetal blood pH was below 7.05, measuring 4 (11.42%) in the forceps group and 4 (4.87%) in the vacuum group, with a statistically significant difference (p=0.001). The results were statistically significant. Table 4 displays the maternal outcomes. A notable disparity existed between the two groups regarding cervical tears and sphincter injuries. The incidence of cervical tears was 14.28% (5 cases) in the forceps group and 30.48% (25 cases) in the vacuum group, with a p-value of 0.001. The incidence of sphincter injury was 25.71% (9 cases) in the forceps group and 7.31% (6 cases) in the vacuum group, with a statistically significant difference (p=0.001).

DISCUSSION

In our study, the majority of patients who underwent operative vaginal delivery were nulliparous, and an episiotomy was performed on nearly all of the patients. A prolongation of the second stage of labor was the most prevalent indicator Apgar scores were considerably lower in the forceps group at both the first and fifth minute. The need for newborn intensive care and the occurrence of brachial plexus injury was significantly higher in the forceps group when fetal blood pH was below 7.05. The cervical tear occurred at a higher location in the vacuum group. Operative vaginal delivery (OVD), which involves the use of forceps or vacuum, is a frequently performed method to facilitate vaginal delivery in situations where labor progress has stalled or there is fetal distress during the second stage. When used appropriately, OVD can be a safe alternative to cesarean delivery.[13] OVD complications are more probable in women who have undergone induction of labor due to prolonged rupture of membranes or possess a higher estimated fetal weight.[14] When a cesarean section is done during the second stage of labor, there is a

higher chance of respiratory problems in the baby, the need for intensive care after the surgery, excessive blood loss, damage to the bladder, ureter, and colon, as well as an increased risk of infection in the mother.[15,16] The incidence of maternal and newborn trauma has risen due to the decrease in the utilization of operative vaginal delivery.[17] In general, under specific and cautious conditions, both vacuum and forceps are linked to relatively low risks of severe illness and death in both the mother and the baby.[18] However, there has been a decline in operative vaginal delivery worldwide, with a more significant decline in forceps delivery.[19,20] Vaginal, cervical, and perineal tear rates were higher in the forceps group.[21]

Maternal morbidity is lower with assisted vaginal delivery using vacuum extraction compared to forceps.[22,23]

Based on literature statistics, the use of forceps during childbirth is more commonly linked to lower Apgar scores, longer stays in the newborn critical care unit, and visible marks caused by the tools.[24] Our research showed that babies born with forceps were more likely to have sphincter damage, Apgar scores below 5 in the first minute and below 7 in the fifth minute, higher rates of hospitalization in the neonatal critical care unit, and more brachial plexus injuries. Our study demonstrates that a vacuum is superior to the use of forceps. Performing an episiotomy before using a vacuum technique is an efficient method for decreasing fetal problems.[25] During our trial, we conducted mediolateral episiotomies on both the vacuum and forceps groups as part of our usual. Levator avulsion is the definitive separation of the puborectalis muscle from the lower part of the pubic ramus. According to studies, using forceps significantly increases the likelihood of levator avulsion.[26] Forceps delivery poses a greater risk of anal sphincter damage compared to vacuum delivery.[27] Operative vaginal delivery with forceps and mediolateral episiotomy caused nearly three times more anal sphincter damage than vacuum delivery (6.1% versus 2.3%).[28] The Research conducted in the Netherlands corroborated the findings of the Cochrane review, reporting rates of 3.4% and 2.5%, respectively.[29] In our study, the incidence of anal sphincter injuries was nearly three times higher in women who underwent forceps delivery with mediolateral episiotomy compared to those who underwent vacuum delivery with mediolateral episiotomy (20.00% versus 7.31%). European countries have entirely phased out the use of forceps.[30] The prevailing global pattern in instrument utilization is disproportionately inclined toward the vacuum.[31] In our study, the vacuum level used during delivery was nearly 2.5 times higher in women who underwent a forceps delivery. The score is 82, compared to 35.

Strengths and Limitations

The restricted generalizability of the study outcomes stems from their short-term nature and the fact that they were done only at a single tertiary institution.

CONCLUSION

Our investigation has demonstrated the superiority of vacuum delivery over forceps delivery. Under specific conditions, vacuum delivery is linked to lower rates of severe illness and death for both the mother and the baby compared to forceps.

Disclosures

Ethics Committee Approval: The study was approved by the İstanbul Kanuni Sultan Süleyman Training and Research Hospital Clinical Research Ethics Committee (No: 2023.09.126, Date: 21/09/2023).

Authorship Contributions: Concept: A.B.; Design: A.B.; Supervision: A.B., N.Ö.; Data Collection or Processing: N.Ö.; Analysis or Interpretation: A.B., N.Ö.; Literature Search: A.B., N.Ö.; Writing: A.B.; Critical review: A.B., N.Ö.

Conflict of Interest: No conflict of interest was declared by the authors.

Informed Consent: Given that the research was carried out retrospectively, patient consent was not necessary for their involvement in the study or publication of the findings. Nevertheless, before undergoing operative vaginal delivery, all patients duly provided signed and informed permission.

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