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Original Investigation

Comparison of Maternal and Neonatal Outcomes of Operative Vaginal Deliveries: Vacuum vs. Forceps

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Abstract

Objective: A vaginal delivery accomplished using either forceps or vacuum is termed as operative vaginal delivery. The aim of this study is to compare indications of maternal and neonatal outcomes between operative vaginal deliveries using forceps (the forceps group) and vacuum (the vacuum group) at our tertiary institute.

Methods: This is a retrospective observational study on operative vaginal deliveries performed between January 2016 and December 2016 at a tertiary hospital in Istanbul. All patients who underwent instrumental vaginal delivery were compared in terms of demographic data, indications, and maternal and neonatal outcomes.

Results: The incidence of operative vaginal delivery was 1.4% of all deliveries. Most patients were primigravida. The most common indication was fetal distress in the vacuum group and prolonged second-stage labor in the forceps group. There was no significant difference in terms of maternal and neonatal morbidities, except for fetal blood pH level. Fetal blood pH level was significantly lower in the vacuum group than in the forceps group.

Conclusion: Risks and benefits of both instruments must be individualized, and operative vaginal deliveries should be performed only if considered a safe alternative. The choice of instrument depends on the operator's skills and training.

Keywords: Forceps, vacuum, operative vaginal delivery

Introduction

The term operative vaginal delivery refers to a delivery in which the operator uses an instrument to extract the fetus from the vagina. The two alternatives for instrument are vacuum and forceps (1, 2). The surgical alternative to operative vaginal deliveries is cesarean section (3, 4).

Recently, the rates of birth by cesarean have risen throughout the world. With operative vaginal deliveries, cesarean section can be avoided, as well as morbidity and mortality caused by it. In many studies, the comparison of vacuum and forceps instruments has been made (5-8). In both the methods, the risk for the mother and the fetus rises, compared to spontaneous vaginal deliveries. There are different rates of maternal and neonatal complications listed in the literature. Poor maternal and neonatal outcome has been reported after the consecutive use of vacuum and forceps (9). Moreover, it has been shown that maternal injuries are more frequent and severe. Although operative vaginal delivery rate has not changed over the years, the rate of forceps use has decreased, and the rate of vacuum use has risen (10-11).

In the light of such information, it was aimed to compare the indications, complications, and maternal and neonatal results of forceps and vacuum applications in operative vaginal deliveries at our clinic, which is a tertiary health center, considering the literature information.

Material and Methods

Our study is a retrospective study that was conducted at İstanbul Kanuni Sultan Süleyman Education and Research Hospital between January 2016 and December 2016. Operative vaginal deliveries were examined from the hospital records following our hospital's ethics committee approval. A total of 105 operative deliveries were performed in our hospital between these dates. Patient consent was obtained before all the procedures. Seven cases were excluded from the study due to missing registries. A total of 98 operative vaginal deliveries were included in this retrospective study. Fifty-five forceps cases and 43 vacuum cases were compared in terms of demographic data, indications, and maternal and neonatal results. Exclusion criteria were multiple pregnancies, preterm birth, and in utero mort fetuses.

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Vacuum deliveries were carried out by metal heads that were 40, 50, and 60 mm in diameter, and 0.6 kg/cm^2 pressure was applied. Simpson forceps were used in forceps deliveries.

Perineal, vaginal, and cervical lacerations, postpartum hysterectomy, and postpartum hemorrhage were examined for maternal results. In both the groups, we examined the 1st and 5th minute Apgar scores, neonatal jaundice, face and scalp lacerations, cephalohematomas, and hospitalizations in neonatal intensive care unit as neonatal complications.

Statistical Analysis

Statistical analyses in this study were conducted using Statistical Package for Social Sciences 16.0 (SPSS Inc.; Chicago, IL, USA) program. For evaluation of data in addition to descriptive methods (mean, standard deviation), independent t-test was used for comparison of paired groups, and chi-squared test was used for comparison of qualitative data. The results were evaluated at the significance level of $p<0.05$.

Results

A total cesarean rate in our hospital in the study period was 43.2%, and primary cesarean rate was 13.6%. A total of 7543 vaginal deliveries were performed in our hospital between January 2016 and December 2016. One hundred and five of these deliveries were operative vaginal deliveries (1.4%). Seven cases were excluded from the study due to missing data. In the study group, there were 55 forceps and 43 vacuum deliveries. The two groups were compared in terms of demographic data, indications, and maternal and neonatal results.

The mean maternal age in the forceps group was 26±6.61 years, and it was 26.55±6.66 years in the vacuum group. Seventy point nine percent of the forceps deliveries, and 55.8% of the vacuum deliveries were nulliparous. Hematocrit values of gestational week and before and after delivery were not different statistically (Table 1). The mean birth weight in the forceps group was 3277.5±394.2 grams, and it was 3409.4±371.3 grams in the vacuum group.

The most common indication in the forceps group was the extension of the second stage. The most common indication in the vacuum group was fetal distress, and it was significantly higher compared to the forceps group. The indications of maternal heart disease and maternal fatigue were not different between the two groups (Table 2).

Episiotomy, postpartum transfusion, vaginal lacerations, postpartum hemorrhage, cervical tears, sphincter injuries, and postpartum hysterectomy data were evaluated as maternal results. Although episiotomy, vaginal lacerations, postpartum hemorrhage, and cervical tears were higher in the forceps group, we detected that it was not statistically significant. We detected that although sphincter injury, postpartum transfusion, and postpartum hysterectomy were not statistically significant, they were more frequent in the vacuum group compared to the forceps group (Table 3). We conducted power analysis between the two groups according to maternal complications, and we detected it as 96.45%.

Fetal blood pH values, rates of hospitalization in the neonatal intensive care unit, cephalohematoma, injury of brachial plexus, neonatal jaundice, and the 1st and 5th minute Apgar scores were evaluated. Fetal blood pH values were significantly lower in the vacuum group. We observed the rates of hospitalization in the neonatal intensive care unit, and injuries of brachial plexus were more frequent in the forceps group, however it was statistically significant. Although the rates of cephalohematoma, neonatal jaundice, the 1st minute Apgar<5 and 5th minute Apgar<7 were not statistically significant in the vacuum group, they were higher (Table 4).

Table 1. Demographic data

	Forceps (n=55)	Vacuum (n=43)	p
Gestation week	38.61±1.23	38.95±1.21	0.860
Age	26.00±6.61	26.55±6.66	0.784
Hematocrit before delivery	37.67±3.44	37.93±3.76	0.547
Hematocrit after delivery	32.4±4.25	32.41±3.65	0.290
Nulliparity	39 (%70,9)	24 (%55,8)	0.122

Table 2. Indications

	Forceps (n=55)	Vacuum (n=43)	p
Extension of the 2nd stage	22 (40%)	11 (25.6%)	0.134
Fetal distress	11 (20%)	22 (51, 2%)	0.001
Maternal heart disease	3 (5.5%)	2 (4.7%)	0.858
Maternal fatigue	19 (34.5%)	8 (18.6%)	0.080

Table 3. Neonatal results

	Forceps (n=55)	Vacuum (n=43)	p
Fetal birth rate (gr)	3277.5±394.2	3409.4±371.3	0.995
Fetal blood pH	7.26±0.09	7.19±0.17	0.002
Requirement of neonatal intensive care	11 (20%)	6 (%14)	0.433
Cephalohematoma	1 (1.8%)	3 (7%)	0.200
Injury of brachial plexus	2 (3.6%)	0 (0%)	0.206
Neonatal jaundice	3 (5.5%)	3 (7%)	0.755
Fetal blood pH<7.05	2 (3.6%)	7 (16.3%)	0.032
1st minute Apgar<5	3 (5.5%)	6 (14%)	0.148
5th minute Apgar<7	2 (3.6%)	6 (14%)	0.064

Table 4. Maternal results

	Forceps (n=55)	Vacuum (n=43)	p
Episiotomy	48 (87.3%)	36(83.7%)	0.618
Transfusion after delivery	2 (3.6%)	4(9.3%)	0.246
Vaginal laceration	9 (16.4%)	5(11.6%)	0.506
Postpartum hemorrhage	2 (3.6%)	1(2.3%)	0.709
Cervical tear	3 (5.5%)	2 (4.7%)	0.858
Sphincter damage	1 (1.8%)	1 (2.3%)	0.860
Postpartum hysterectomy	0 (0%)	2 (4.7%)	0.106

Discussion

Birth rates by cesarean in the recent years have risen throughout the world (12). Operative vaginal deliveries are important for decreasing birth rates by cesarean and related morbidities (1). The rates of operative vaginal deliveries vary from country to country and even from center to center. While operative vaginal delivery rate reported in the developed countries is 10%–15%, it is 1%–3% in the developing countries (13, 14). The operative vaginal delivery rate in our study is 1.4%. The reasons for such a low rate are medicolegal problems, loss of operative vaginal delivery doctrines in years, and the birth rates by cesarean (15, 16).

Vacuum and forceps are two instruments used in operative vaginal deliveries. The choice of instrument depends on the preference and experience of the obstetrician. In the recent years, while the use of forceps has decreased, the use of vacuum has increased. The reasons for this are randomized studies indicating that maternal trauma is higher in delivery by forceps compared to delivery by vacuum and the developments in the vacuum equipment (17). Various studies indicate that operative vaginal deliveries are more common in nulliparous parturients. The reason for this is that the second stage of delivery is longer, and maternal fatigue is more frequent in primigravid women (18, 19). In our study, 70.9% of forceps deliveries and 55.8% of vacuum deliveries took place in nulliparous parturients.

Indications for operative vaginal delivery are fetal distress, maternal heart disease, extension of the second stage, and maternal fatigue. In our study, we have displayed that the instrument of choice in fetal distress cases in our hospital is vacuum. The difference between the groups in terms of other indications is not statistically significant. In different studies, the preference in fetal distress cases is in the direction of vacuum. The studies showing that forceps is preferred more often in fetal distress cases have reported that they have preferred forceps since it can be applied faster than vacuum (20-22).

Opening episiotomy in operative vaginal deliveries depends on the preference of the obstetrician. In our study, routine episiotomy application was not performed both in the vacuum and forceps groups; however, episiotomy was applied more often in the forceps group than in the vacuum group. The reason for this is to prevent maternal complications due to studies indicating that maternal injury is higher in forceps applications. In some studies, routine episiotomy was performed in forceps applications. The Cochrane database has displayed that maternal morbidity is less in the vacuum group than in the forceps group. It has been displayed that the anesthesia requirement in vacuum application and the pain during and after delivery are reduced (10, 23, 24).

There are studies indicating that anal sphincter injuries are more frequently seen in forceps deliveries; however, no significant difference was seen in our study. It was indicated in the randomized controlled study conducted by Eason et al. (25) that the relative risk of sphincter damage in forceps application increased 4.9 times compared to vacuum application.

In our study, no difference was observed between the two groups in terms of maternal complications such as perineal and cervical lacerations. Postpartum hysterectomy was performed in 2 patients in vacuum group due to uterine rupture.

Neonatal morbidity has been reported at different rates in the literature. It was indicated in the Cochrane review consisting of nine controlled randomized studies that vacuum did not lead to low Apgar scores compared to forceps (10). In our study, fetal blood pH was found to be significantly low in the vacuum group. The reason is that, in our study, deliveries with the fetal distress indication in the vacuum group were higher.

There are many studies that indicate that cephalohematoma and neonatal jaundice are observed more often in the vacuum group. There are literature data reporting that low Apgar scores, hospitalization in neonatal intensive care unit, and instrument scars are more often seen in the forceps group (26, 27). In our study, we observed that the rates of hospitalization in neonatal intensive care unit and injuries of brachial plexus from neonatal complications were more common in the forceps group; however, we did not detect it as statistically significant. Although the rates of cephalohematoma, neonatal jaundice, and the 1st minute Apgar<5 and the 5th minute Apgar<7 in the vacuum group were not statistically significant, they were higher.

Conclusion

Consequently, operative vaginal deliveries are suitable in available conditions to decrease the rates of cesarean deliveries and related morbidity and mortality. Our study has not displayed either the superiority of vacuum over forceps or forceps over vacuum. Both the methods have advantages and disadvantages. The preference of instrument should be individualized according to the patient and the experience of obstetrician.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Kanuni Sultan Süleyman Training and Research Hospital.

Informed Consent: Informed consent is not obtained due to the retrospective nature of this study.

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