

Fetomaternal trauma in instrumental deliveries - a retrospective comparative study

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Manuscript submitted – 5th July 2020

Peer review completed – 17th August 2020

Accepted for Epub – 7th September 2020

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Abstract:

Objective: This study was undertaken to compare the fetomaternal trauma in forceps and vacuum deliveries. **Methods:** 103 forceps and 103 vacuum deliveries considered in this retrospective study. Maternal outcome is assessed in terms of episiotomy extension, vaginal tears, cervical tears, exploration and repair under anesthesia, blood transfusion, vulval hematoma, puerperal pyrexia, and maternal mortality. Fetal outcome is assessed in terms of Apgar score, respiratory distress, birth asphyxia, meconium aspiration syndrome (MAS), necrotizing enterocolitis, hypoxic ischemic encephalopathy (HIE), hyperbilirubinemia, infection, duration of neonatal intensive unit (NICU) stay, birth injuries and infant mortality. **Results:** 85% of instrumental deliveries were conducted by consultants and 15% by residents. Decision to delivery interval was significantly lower in forceps compare to vacuum deliveries. Episiotomy extension and vaginal tears were significantly higher in forceps compare to vacuum. There was no significant difference in cervical tears, exploration and repair under anesthesia, blood transfusion, puerperal pyrexia, sepsis and maternal mortality. Apgar score, respiratory distress, birth asphyxia, MAS, necrotizing enterocolitis, HIE, hyperbilirubinemia, infection, duration of NICU stay and infant mortality was not significant between 2 groups. **Conclusions:** Vacuum delivery is associated with less maternal trauma compare to forceps delivery with no difference neonatal outcome. Skill training for instrumental deliveries with modern education tools, simulators and hands on training for residents is need of the hour to achieve maternal and neonatal safety. Reasonable judgment in choosing cases along with skilled operators can reduce unwarranted caesarians in second stage.

Keywords: Maternal outcome, neonatal outcome, respiratory distress, birth asphyxia, episiotomy extension, vaginal tears, cervical tears, 3rd degree perineal tear, complete perineal tear.

Instrumental delivery is safe option for practicing modern obstetrics in second stage of labor. It is an essential skill for practicing obstetrician to reduce maternal and neonatal morbidity in second stage. Complications of delivery and obstructed labor accounted for 9.6% of all maternal deaths worldwide¹. World has seen decreasing trend in instrumental deliveries with the rise of caesarian section rate. Data from UK² stated that, the instrumental deliveries are 10% which has been constant since several years with preference to vacuum delivery. Instrumental deliveries have key role in reducing maternal and fetal morbidity but compare to developed countries it is underused in developing world. The reasons for decreasing trend are being fear of litigation, lack of skill training, availability of

resources and fear of complications. Hence this study was undertaken to compare injuries associated with instrumental deliveries in the developing countries.

Materials and methods

This observational retrospective study was conducted at tertiary care maternity hospital, Pondicherry between January 2017 to June 2018 for a period of 18 months. Details of patients who had instrumental deliveries collected from birth register. Consecutive 103 forceps and 103 vacuum delivery patients who fulfilled inclusion criteria considered for study. Case sheets were collected from medical record section and scrutinized for demographic characteristic, parity, gestational age, medical and obstetrical complications, indications for instrumental delivery, fetal and neonatal outcome following delivery. Malpresentation, gestational age <36 weeks, fetal head station-above+1, dead baby, cervical dilatation <10cms, failed instrumental delivery, sequential use of instruments for delivery, multiple pregnancy and previous lower segment caesarian section (LSCS) cases excluded from study.

Metal and sialistic cups were used in vacuum delivery. Negative pressure applied up to 0.6kg/cm². Mid cavity forceps with or without axis traction device and outlet forceps were used forceps delivery.

Maternal outcome is assessed in terms of episiotomy extension, vaginal tears, cervical tears, exploration and repair under anesthesia, blood transfusion, vulvar hematoma, puerperal pyrexia, urinary retention, sepsis, neuropraxia and maternal mortality. Fetal outcome is assessed in terms Apgar score, respiratory distress, birth asphyxia, meconium aspiration syndrome, necrotizing enterocolitis, hypoxic ischemic encephalopathy, hyperbilirubinemia, infection, duration of stay at NICU, birth injuries and infant mortality. The collected was analyzed and tabulated.

The quantitative variables between the two groups were compared using parametric (T-independent test) and non-parametric tests (Mann Whitney U test), wherever appropriate. As for the qualitative variables, the significance of their occurrence in the two groups was compared in terms of proportions. Proportions wherever necessary were compared using Chi square or Fisher's test which ever was appropriate. In all comparisons, a P-value of <0.05 was considered to be statistically significant.

Results

The total number of deliveries for 1 year was 19440. Total number of LSCS were 4471(22.99%) and instrumental deliveries were 748(3.8%) among which 481(64.3%) were forceps deliveries and 267(35.7%) were vacuum deliveries. 85% of instrumental deliveries were conducted by consultants and 15% of instrumental deliveries were conducted by residents.

Demographic characteristics		Forceps Delivery	Vacuum delivery	P value
Maternal age in years (Mean±SD)		23±4.1	24±3.9	NS
Height in cm	135-144	4(3.88)	1(0.97)	NS
	145-154	89(86.4)	87(84.46)	NS
	155-166	10(9.70)	15(14.56)	NS
Parity	Primigravida	88(85.44)	77(74.76)	NS
	Multi gravid	15(14.56)	26(25.24)	NS
Period of gestation (Week)	36	1(0.98)	2(1.95)	NS
	37	2(1.95)	1(0.98)	NS
	39-40	100(97.09)	95(92.24)	NS
NS – Nonsignificant				

Demographic profile of the patients described in table 1. There was no significant difference among two groups of patients in terms of height, weight, age parity and gestational age.

Position	Forceps (N, %)	Vacuum (N, %)	P value
Left occipito-anterior	98(95.15)	61(59.23)	< 0.05
Left occipito-transverse	1(0.98)	38(36.9)	< 0.05
Occipito-posterior	4(3.89)	4(3.89)	NS
Station			
+1	5(4.86)	11(10.68)	NS
+2	77(74.76)	88(85.44)	NS
+3	21(20.39)	4(3.89)	P <0 .05

The proportion of cases with different positions among the forceps and vacuum group are shown in table 2. It was observed that the proportion of cases in with position “left occipito-anterior” was significantly higher in the forceps group when compared to the same in vacuum group. It was observed that the proportion of cases with position “left occipito-transverse” was found higher in the vacuum group. The proportion of cases with position “posterior” was almost the same in both the groups. Proportion of cases with station of +3 was significantly higher in the forceps group when compared to the same in the vacuum group (p =0.0002).

Maternal indication	Forceps (N, %)	Vacuum (N, %)	P value
Anemia in failure	2(1.94)	2(1.94)	NS
Cardiac disease	1(0.97)	2(1.94)	NS
Severe PIH/ Eclampsia	3(2.91)	1(0.97)	NS
Fetal indication			
Fetal distress	18(17.48)	7(6.8)	<0.05
Cord prolapse	1(0.97)	0(0)	NS
Obstetrical indication			
Failure of maternal power	46(44.66)	16(15.53)	<0.05
Prolonged 2 nd stage	30(29.12)	22(21.36)	NS
Short of rotation	2(1.94)	53(51.46)	<0.05

Indication for instrumental delivery is described in table 3. It is observed that for all the possible indications listed, the proportion of cases with short of rotation was significantly higher among vacuum group (p value <0.05). Forceps method was common mode of delivery in the indications like fetal distress and failure of maternal power compared to vacuum group.

The color of liquor among the cases in the two groups is shown in table 4. There was no association between color of liquor and the type of delivery method used (p > 0.05).

Meconium status	Forceps (N, %)	Vacuum (N, %)	P value
Clear	88(85.44)	78(75.73)	NS
Thin	7(6.8)	12(11.66)	NS
Thick	8(7.77)	13(12.63)	NS

96 (93.2%) of forceps group and 83 (80.5%) of vacuum group had delivery with 3 or less pulls. 7(6.8%) among forceps group and 20(19.4%) of vacuum group had delivery with >3 pulls. Maximum 5 pulls were used for

instrumental delivery. The difference was statistically significant between 2 groups. The decision-to-delivery interval was 10 ± 5.4 min for forceps delivery compare to 17 ± 6.2 minutes for vacuum deliveries. P value was < 0.05 which is statistically significant.

Birth weight (Kg)	Forceps	Vacuum	P value
<2	3(2.92)	5(4.86)	
2-2.5	24(23.31)	26(25.25)	
2.6 -3	47(45.64)	47(45.64)	
3.1-3.5	26(25.25)	22(21.36)	
>3.5	3(2.92)	3(2.92)	
Mean \pm SD	2.92 \pm 0.04	3 \pm 0.04	NS
Apgar score			
<3	2(1.95)	3(2.92)	NS
3-6	23(22.34)	18(17.48)	NS
>6	78(75.73)	82(79.62)	NS
NICU stay (in days)			
<1	43(41.75)	47(45.64)	NS
1-5	52(50.49)	50(48.55)	
>5	8(7.77)	6(5.83)	

Neonatal outcome is described in table 5. There was no statistical difference in birth weight between the groups. There was no statistical significant difference between two groups when duration of NICU stay is concerned (chi square 0.05, P = 0.77). The mean of Apgar score at birth for forceps and vacuum delivery was 7.1 and 7.2 respectively. There was no statistical difference in Apgar score at birth in either the group.

Maternal injuries	Forceps (N, %)	Vacuum (N, %)	P value
Episiotomy extension	18(17.48)	1(1.0)	<0.05
Vaginal tears	15(14.55)	4(3.9)	<0.05
Cervical tears	2(1.9)	1(1.0)	NS
3 rd degree perineal tear	1(.97)	2(1.9)	NS
Complete perineal tear	1(.97)	2(1.9)	NS
Other complications			
Exploration and repair under anesthesia	3(2.9)	1(0.97)	NS
Blood transfusion	3(2.9)	4(3.9)	NS
Vulval hematoma	0(0.0)	1(0.97)	NS
Puerperal infection	7(6.79)	3(2.9)	NS
Postpartum hemorrhage	7(6.79)	4(3.9)	NS

The Maternal outcome is presented in table 6. Episiotomy extension and vaginal tears were significantly higher in forceps compare to vacuum delivery. Infection was common in forceps but difference was not significant. We did not find any urinary retention and neurological injuries.

Perinatal outcome	Forceps (N, %)	Vacuum (N, %)	P value
Respiratory distress	3 (2.9)	6(5.3)	NS
Birth asphyxia	16(15.5)	26(25.2)	NS
Meconium aspiration syndrome	16 (15.5)	8(7.8)	NS
Hypoxic ischemic encephalopathy	2 (1.9)	3(2.9)	NS
Hyperbilirubinemia	1(0.97)	4(3.9)	NS
Infection	0(0.0)	1(0.97)	NS
Brachial plexus injury	1(0.97)	0(0.0)	NS
Eye injuries	6(5.8)	0(0.00)	<0.05

Mortality	4 (3.9)	3 (2.9)	NS
Cephalhematoma	0(0.0)	8(7.8)	<0.05
NICU stay > 5 days	8(7.77)	6(5.83)	NS

Birth asphyxia was commonly (25%) seen in of vacuum deliveries but meconium aspiration syndrome (15.5%) commonly seen forceps deliveries but the difference was not statistically significant. Eye injuries which included 4 subconjunctival hemorrhage and 2 corneal tears was among forceps group with no eye injuries in vacuum group, difference was statistically significant. There was no cephalhematoma in forceps group compare to vacuum with 8 cases and statistical difference was significant.

Discussion

Instrumental deliveries are safe obstetric skills when chosen the cases appropriately. In our study the rate of instrumental deliveries was 3.8% which is much lower compare to other studies^{3, 4} from India. Data from sub-Saharan Africa has stated much lower instrumental deliveries (<1%). 40% of sub-Saharan African countries and 30% Asian countries, never used or taught vacuum extraction⁵. In the US, instrumental delivery reduced from 9.01% of all deliveries in 1992 to 3.30% in 2013⁶. Replacement of high and rotational forceps deliveries by caesarian deliveries, unavailability of instruments, less usage of obstetric analgesia and poor quality training in developing countries may be the reasons for this trend. In our study, 85% instrumental deliveries were conducted by specialist and 15% by residents. Only prophylactic instrumental vaginal deliveries were given to residents. Many young doctors complete their post-graduation with minimal hands on experience for instrumental deliveries. Sentilhes L, et al⁷ observed that operative vaginal delivery managed by an obstetric resident under supervision was not associated with a greater rate of severe maternal and neonatal morbidity. Obstetricians need to be competent of conducting instrumental deliveries certain inevitable situations. Dr. Nicola Perone⁸ devised high-fidelity simulator which makes easier for young doctors to become proficient. Simulator training along with hands on experience may help residents to become self-confident and gives them the ability to teach their juniors.

UK data suggest that 10-15%⁹ of all deliveries are instrumental deliveries with preference to vacuum. In our study forceps was preferred instrument with ratio being 1.8 contrary to other studies^{3, 10}. Though vacuum is having advantage of technical simplicity and less maternal trauma, non availability of modern cups and complex maintenance may be the reasons for this trend in our hospital. Metal cups were frequently used and kiwi cups were not available at the time of study.

Choosing the right case for instrumental delivery influences the outcome of delivery. Women with occipito-anterior position and station at +3 were forceps was preferred instrument but vacuum was preferred in occipito-transverse position. As the rotational forceps deliveries has seen downward trend vacuum being used wherever rotation is required. The reasons for this trend may be ease of application of vacuum in malrotated head compare to forceps.

In our study, forceps were preferred in cases of fetal distress and failure of maternal efforts in accordance with other studied^{3, 11} but vacuum is preferred in malrotation. We achieved quicker 'decision to delivery interval' in forceps compare to vacuum (10 ± 5.4 vs. 17 ± 6.2 minutes) which was similar to other studies¹². This finding favors preference for forceps in fetal distress.

Overall maternal trauma in instrumental deliveries accounts for 13.5% in our study. Occurrence of genital trauma in forceps deliver was high (18.4%) compare to vacuum (8.7%). Routine episiotomy with operative vaginal delivery is not recommended because poor healing and prolonged discomfort¹³. Vaginal tears and extension of episiotomy among forceps was significantly high comparatively all though episiotomy was given for all instrumental deliveries. Vacuum seems to be safe for the mother compare to forceps in our study. This finding is in accordance with cochrane database¹⁴ review study. Retrospective cross-sectional study conducted in Ethiopia¹⁵ found that mothers who had forceps delivery were 3.4 times more likely to develop maternal complication than vacuum delivery. Cochrane database¹⁴ review shown third and fourth degree perineal tears occur more frequently if forceps compare to vacuum. Contrary to other studies^{3, 16} our study did not show any difference in occurrence of sphincter injuries in forceps compare vacuum. Although there was increased maternal trauma in forceps wound infection rates were comparable. José A et al¹⁷ studied levator ani muscle injury in operative vaginal delivery with Malmström vacuum

or Kielland forceps and they did not find any difference between groups. Change in the profile of patients, anemia, obesity and increasing trends in diabetes complicating pregnancy have multiple consequences both maternal and fetal health. Hence there is need for further studies.

Birth injuries associated with difficult operative deliveries one of the common litigations in obstetrics practice. Our study showed higher incidence of cephalhematoma in vacuum group compare to forceps which was similar to other studies^{3,11,18}. Use of metal cups increase the chance of cephalhematoma compares to silastic cups. In our hospital metal cups were used more often comparing to silastic cups. We did not find severe complications like hypotension and anemia in cephalhematoma cases. Difficult vacuum deliveries, such as occipito-posterior or transverse position and fetal mid station, predispose to increased scalp injuries¹⁹. This can be minimized by correct assessment of position, right application of the cup, prevention of slippage of cup and traction in appropriate direction. Subconjunctival hemorrhage and corneal tears were more frequently seen forceps group however cases were managed conservatively without any surgical intervention. Prapas et al²⁰ demonstrated low Apgar scores at 1 minute in forceps group compare to vacuum however neonatal trauma did not differ. In our study neonatal outcome did not differ in terms of Apgar scores, birth asphyxia, respiratory distress, prolonged NICU stay and sepsis.

Limitations: This is a cross-sectional study hence it was not possible to establish causal relationship between variables and the mode of delivery. Being retrospective in nature important parameters like body mass index of the mother, hemoglobin levels, and diabetic status were not addressed in this study. Sequential use of instrument and failed instrumentation were not included in the study. The study was conducted in a single hospital; the results might not be a representative of other institutions.

Conclusions

Vacuum delivery is associated with less maternal trauma compare to forceps delivery with no difference neonatal outcome. Selection of cases and skill of the operator determined fetomaternal outcome of instrumental delivery. Reduced incidence of instrumental deliveries in developing world need to be addressed in order to prevent obstructed labor in second stage of labor. Skill training for instrumental deliveries with modern education tools, simulators and hands on training for residents is need of the hour to achieve maternal and neonatal safety. Reasonable judgement in choosing cases along with skilled operators can reduce unwarranted caesarian sections in second stage.

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Conflict of interest: None. **Disclaimer:** Nil.