Original Article

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Fetomaternal Outcomes between Instrumental Vaginal Delivery and Caesarean Section in Second Stage of Labour: A Prospective Interventional Study

Obstetrics and Gynaecology Section

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ABSTRACT

Introduction: Rates of caesarean section deliveries are increasing worldwide including India. The reasons for this increasing trend are many. Caesarean section being a major operative procedure is associated with various complications. Instrumental vaginal delivery has the advantage of reducing these complications associated with caesarean delivery. As of today, there is no clear consensus regarding the safest and most effective mode of intervention in second stage of labour.

Aim: To compare foetal and maternal outcomes between instrumental vaginal delivery and caesarean section in second stage of labour.

Materials and Methods: It was a hospital-based prospective interventional study, conducted over a period of 18 months. A total of 104 mothers with live, singleton, term foetuses in vertex presentation who required intervention in second stage of labour were included in the study. The entire study population was divided into two groups depending on the type of intervention used in second stage- instrumental vaginal delivery (n=52) and caesarean section (n=52). Maternal outcomes of Postpartum Haemorrhage (PPH), perineal lacerations, febrile illness, blood transfusion and wound infection were compared using Chi-square test. Neonatal outcomes like birth weight, need for resuscitation, Appearance, Pulse, Grimace, Activity, and Respiration (APGAR) score, neonatal jaundice, sepsis and mortality were compared using Chi-square test and t-test.

Results: Females undergoing caesarean section had more atonic PPH (5.8%), need for blood transfusion (19.2%), postpartum wound infection (17.3%) and febrile illness (26.9%, p=0.010). Third and fourth degree perineal lacerations were more common in the instrumental delivery group (19.2%, p=0.001). Mean weight of babies born by caesarean section (3127 g) was higher than those by instrumental delivery (2962 g). Composite neonatal outcome was not significantly different in both groups.

Conclusion: Caesarean section in second stage of labour leads to increased maternal morbidity as compared to instrumental vaginal delivery. In skilled hands, these instruments can aid in smooth delivery of a healthy baby and can avoid the risks associated with second stage caesarean section.

Keywords: Forceps, Operative vaginal delivery, Perineal lacerations, Ventouse

INTRODUCTION

After eras of use in Obstetrics, have forceps and vacuum deliveries become a vanishing art? In this era of increasing number of caesarean deliveries, this age old instruments seem to have lost their place in Obstetrics. But, it should not be forgotten that no procedure is obsolete in Obstetrics. There has been a recent trend of increasing rates of caesarean deliveries globally including India. According to the recent National Family Health Survey 4 (NFHS 4), the average rate of caesarean section in India is 17.2% ranging from 5.8% in Nagaland to 58% in Telangana [1]. The reasons for this increasing trend of caesarean deliveries are many. Apprehensions over neonatal and maternal protection have been the main drivers of these trends. There are fewer clinicians trained in using forceps who are able to teach residents. Professional liability has also had an impact, as birth injuries are associated with delayed caesarean section and difficult operative deliveries are a common cause of obstetric malpractice suits [2]. In the 2006 American College of Obstetricians and Gynaecologists (ACOG) Survey on Professional Liability, 37.1% of obstetricians reported increasing their rate of caesarean sections due to fear of litigation [3]. Institutions with higher delivery rates prefer instrumental delivery while in private sector, caesarean section is preferred more. Being a major operative procedure the risks associated with caesarean section should not be overlooked and the decision of which method to choose should be individualised.

Labour and childbirth are natural processes and are associated with less morbidity to mother and child as compared to caesarean delivery. Assisting a natural process is much better than completely converting it into an artificial one. Caesarean section being a major operative procedure is associated with various complications such as PPH, wound disruption and injury, venous thromboembolism, infection, anaesthetic complications, delayed recovery time, rising costs, subsequent repeat caesarean section, limitation of obstetric carrier and even death. Instrumental vaginal delivery has the advantage of reducing these complications associated with caesarean delivery [4]. According to the World Health Organisation (WHO) and United Nation (UN) agencies, assisted vaginal delivery is one of the six critical functions of basic emergency care [5]. So, instrumental vaginal delivery procedures should be made available and accessible everywhere especially in low resource countries like India where the need is high and caesarean section as alternative is not always available everywhere.

Labour is divided into four stages and the second stage spans from full dilatation of the cervix to delivery of the baby. Very often events and poor progression in second stage call for intervention which can be in the form of instrumental vaginal delivery or caesarean section. Instrumental vaginal delivery also known as operative vaginal delivery includes forceps and ventouse extraction. All the three methods of second stage intervention have their own advantages and disadvantages in terms of maternal and neonatal outcomes. There is no clear consensus or guidelines regarding the safest

and most effective mode of intervention. There are many studies comparing outcomes of forceps delivery and ventouse extraction [6-8]. However, data comparing outcomes for operative vaginal delivery vs caesarean in the second stage are scant. Many studies vary in outcomes widely [3,9]. This study reflects on the differences in foetal and maternal outcomes in various modes of second stage intervention and helps to choose a safer and efficient method. This knowledge, ultimately will guide clinicians in future to make better obstetric decisions.

MATERIALS AND METHODS

It was a hospital-based prospective interventional study, conducted in Bankura Sammilani Medical College and Hospital, a tertiary level hospital in West Bengal, India, from March 2019 to September 2020. Institute Ethical Committee clearance was sought before commencement of the study (BSMC/Aca/122). Pregnant females with live, singleton, term foetuses in vertex presentation who underwent intervention in second stage of labour were taken as subjects for the study.

Sample size calculation: Sample size was calculated based on the formula adopted for descriptive cohort study at 95% power of test. Sample size for each group,

$$N=(Z_\alpha+Z_\beta)^2\times(p_1q_1+p_2q_2)/(p_1-p_2)^2$$

where Z_α=1.96 at 95% Confidence Interval (CI), Z_β=1.28 at 95% power of test, p_1 and p_2 are proportion of patients developing the event of interest in the study group and comparison group respectively. q_1 and q_2 are the compliments of p_1 and p_2 respectively. Here, we took p_1=19.1(proportion of mothers suffering severe perineal lacerations following ventouse delivery) and p_2=0 (proportion of mothers suffering severe perineal lacerations following cesarean delivery) [8]. Hence, q_1= 80.9 and q_2=100. On applying the formula,

$$N=(1.96+1.28)^2\times(19.1\times80.9+0)/19.1^2=47$$

for each group. Considering 10% non respondent rate, revised sample size for each group was (47+5)=52. The study subjects were selected from all the eligible cases by simple random sampling. A total of 104 study subjects were taken with 52 in each group i.e., caesarean section and instrumental vaginal delivery.

Inclusion criteria: Pregnant females with live, singleton, term foetuses in vertex presentation who underwent intervention in second stage of labour and gave informed consent were included in the study. It included pregnant females at ≥37 completed weeks of gestation (term), gravida one or more, singleton pregnancy, clinically adequate liquor and postdated pregnancy (beyond 40 weeks of gestation).

Exclusion criteria: Mothers with multifoetal pregnancies, diagnosed foetal anomalies, medical disorders, uterine anomalies, previous cesarean section, antepartum haemorrhage, premature rupture of membranes, malpresentation, preterm (<37 weeks), reduced and meconium stained liquor were excluded from the study.

Procedure

Data was collected using a predesigned and pretested tool. Socio-demographic data and basic obstetric information was collected from each of the study subjects. Prior to data collection, written, informed consent was taken from each of the study participants after explaining them the objectives of the study. All instrumental vaginal deliveries were conducted under local anaesthesia and caesarean sections under spinal anaesthesia.

Maternal outcomes were compared in the two groups in terms of PPH (atonic or traumatic), severe lacerations (third or fourth degree), postpartum wound infection, febrile illness, need for blood transfusion and maternal mortality. Third degree perineal lacerations are those which involve the anal sphincter complex and fourth degree lacerations involve anorectal mucosa in addition to anal sphincter complex [10]. Neonatal outcomes were compared in terms of need for immediate resuscitation, birth weight, low 5-minute APGAR score, need for Sick Newborn Care Unit (SNCU) admission, birth complications (fracture, cephalohaematoma), neonatal jaundice, sepsis, convulsions, ventilator support and death.

STATISTICAL ANALYSIS

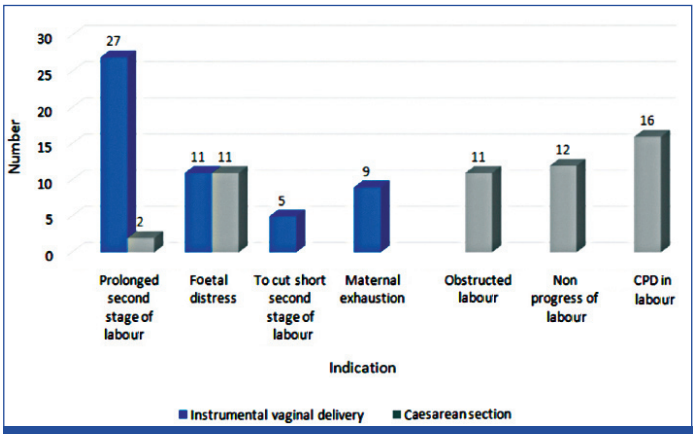
Data was analysed using Statistical Package for the Social Sciences (SPSS) version 27.0. Continuous data was expressed in terms of mean and Standard Error (SE) of mean and proportions in terms of percentages and SE. Associations between categorical variables were carried out using Pearson's Chi-square test and between continuous and categorical variables using unpaired sample t-test. A p-value of <0.05 was considered significant.

RESULTS

There were a total of 104 subjects, 52 in each group. The mean age of females in the instrumental vaginal delivery group was 23.88 years (±3.89) and that of caesarean section group was 24.31 years (±4.30). Majority of the females were primigravidas: 59.6% (n=31) in instrumental delivery group and 65.4% (n=34) in caesarean section group. Only term pregnancies were included in the study [Table/Fig-1]. The most common indication for instrumental vaginal delivery was prolonged second stage of labour (51.9%) followed by foetal distress (21.2%) [Table/Fig-2]. For caesarean section, the most common indication was cephalo-pelvic disproportion (30.8%), followed by non progress of labour (23.1%) [Table/Fig-2]. No significant association was found between indication and type of delivery (p=0.13).

Parameters	Instrumental vaginal delivery n=52	Caesarean section n=52	p-value
Age (years) Mean (±SD)	23.88 (3.89)	24.31 (4.30)	0.525 (Unpaired sample t-test)
Religion N (%)			
Hindu	42 (80.8)	39 (75.0)	0.778 (Chi-square test)
Muslim	10 (19.2)	13 (25.0)	
Gravida N (%)			
G1	31 (59.6)	34 (65.4)	0.942 (Chi-square test)
G2	18 (34.6)	15 (28.8)	
G3	3 (5.8)	3 (5.8)	
Gestational age (weeks) Mean (±SD)	38.69 (0.87)	39.00 (0.97)	0.063 (Chi-square test)
Sex of the baby N (%)			
Male	28 (53.8)	28 (53.8)	1 (Chi-square test)
Female	24 (46.2)	24 (46.2)	

[Table/Fig-1]: Socio-demographic and obstetric variables.



[Table/Fig-2]: Distribution of indication among instrumental vaginal delivery and cesarean section.
CPD: Cephalo-pelvic disproportion

Atonic PPH was more common among caesarean section mothers (5.8%) as compared to instrumental vaginal delivery (1.9%). Severe

lacerations in the form of third and fourth degree perineal tears were significantly higher in instrumental vaginal delivery group (p=0.001). There were no maternal mortalities in either group. All the maternal outcomes are summarised in [Table/Fig-3].

Variables	Instrumental vaginal delivery (%)	Caesarean section (%)	Chi-square value (χ^2)	df	Significance (p-value)
PPH	Atonic: 1 (1.9) Traumatic: 1 (1.9)	Atonic: 3 (5.78) Traumatic: 0	2.010	2	0.366
Severe lacerations	10 (19.2)	0 (0)	11.064	1	**0.001**
Vulval haematoma	1 (1.9)	0 (0)	1.010	1	0.315
Blood transfusion	5 (9.6)	10 (19.2)	1.948	1	0.163
Postpartum wound infection	3 (5.8)	9 (17.3)	3.391	1	0.066
Postpartum febrile illness	4 (7.7)	14 (26.9)	6.718	1	**0.010**
Maternal mortality	Nil	Nil	-	-	-

[Table/Fig-3]: Data to compare maternal outcomes between the two groups. A p-value of <0.05 was considered significant

Babies born by caesarean section had greater mean birth weight (3127.31±374.80 g) than those born by instrumental vaginal delivery (2962.31±377.57 g). This difference was statistically significant [Table/Fig-4]. Babies born by caesarean section had significantly lower 5-minute APGAR score as compared to instrumental vaginal delivery. No birth injuries in the form of cephalohaematoma, fractures or brachial plexus injury were seen in any of the neonates. There were no neonatal mortalities either.

Variables	Instrumental vaginal delivery N (%)	Caesarean section	Chi-square value (χ^2)	df	Significance (p-value)
Sex of the baby	Male: 28 (53.8) Female: 24 (46.2)	Male: 28 (53.8) Female: 24 (46.2)	0	1	1.00
Birth weight of baby (g)	2962.31 (±377.57)	3127.31 (±374.80)	-	102	0.027[$]
Need for resuscitation	14 (26.9)	18 (34.6)	0.722	1	0.395
5-minute APGAR score (<7)	2 (3.8)	8 (15.4)	3.983	1	0.046
SNCU[¶] admission	17 (32.7)	14 (26.9)	0.414	1	0.520
Neonatal jaundice	10 (19.2)	11 (21.2)	0.060	1	0.807
Neonatal sepsis	6 (11.5)	5 (9.6)	0.102	1	0.750
Neonatal convulsions	2 (3.8)	5 (9.6)	1.378	1	0.240
Ventilator support	0	1 (1.9)	1.010	1	0.315

[Table/Fig-4]: Data to compare neonatal outcomes between the two groups. SNCU (Sick Newborn Care Unit); [$]Unpaired sample t-test was used; p-value <0.05 is significant

DISCUSSION

Satisfactory progress of labour in second stage, vigilant monitoring of maternal and foetal condition and timely intervention whenever needed are crucial for a successful obstetric outcome. Before performing instrumental vaginal delivery through assessment of maternal and foetal condition and fulfilment of prerequisites is mandatory. Application of forceps or vacuum extractor needs skill and training of Obstetricians to avoid adverse outcomes. High and mid-cavity forceps application has become obsolete in modern day obstetrics. Only low and outlet forceps are used. Vacuum extractor is preferred over forceps because of reduced maternal trauma, whilst the failure rate appears to be reduced with forceps [10]. Caesarean section at full cervical dilatation is technically difficult and is associated with increased maternal morbidity. [Table/Fig-5] shows comparison of various studies [9,11-13].

In present study, the socio-demographic and obstetric parameters were not different among both the groups. There was no significant association between age, parity, religion and gestational age of the females and type of delivery. This could be because of the similar socio-demographic background of the mothers attending this tertiary care facility. However, babies born by caesarean section were heavier than those born by instrumental vaginal delivery. This finding was consistent with the available literature [14]. According to the Tan PS et al., elevated maternal BMI, estimated foetal weight over 4,000 g, foetal occipitoposterior position and mid-cavity deliveries are predictive of difficult instrumental deliveries [11]. Caesarean section is more frequent in these conditions. The most common indication for operative vaginal delivery was prolonged second stage and for caesarean section was cephalo-pelvic disproportion. Prolonged second stage of labour is associated with maternal exhaustion, increased chances of infection, foetal academia and neonatal asphyxia. Hence, prompt intervention is needed when labour is unduly prolonged. Cephalo-pelvic disproportion leads to failure of descent, increasing grade of moulding and excessive caput formation. Proper assessment of maternal pelvis and foetal head station by a senior Obstetrician and decision regarding mode of termination is crucial in these cases.

In this study, atonic PPH and need for blood transfusion was more common in caesarean section group (5.8% and 19.2% respectively). Tan PS et al., found that the estimated blood loss with caesarean section was marginally larger [11]. These findings were similar to those of another cohort study on caesarean section at full cervical dilatation which showed a higher risk of PPH and major obstetric haemorrhage of >1000 mL [7]. Caesarean section in second stage

Outcomes	Present study (2021)	Tan PS et at., [11] (2019)	Bailit JL et al., [9] (2016)	Seal SL et al., [12] (2010)	Conroy K et al., [13] (2012)
Maternal outcomes	Atonic PPH (5.8%), Blood transfusion (19.2%), postpartum wound infection (17.3%) and postpartum febrile illness (26.9%, p=0.010) were more common in caesarean section group -3rd or 4th degree perineal lacerations in 19.2% mothers undergoing instrumental delivery (p=0.001).	Estimated blood loss more in caesarean section (p<0.001).	Lowest frequency of maternal complications with ventouse -Infection (0.2% vs 0.9% forceps vs 5.3% caesarean section) - PPH (1.4% vs 2.8% forceps vs 3.8% caesarean section) - 3rd and 4th degree perineal lacerations (19.1% vs 33.8% forceps vs 0% caesarean section).	-Postpartum infection was more in caesarean section 3% vs 0% in instrumental delivery (p=0.004) -No difference in rate of maternal composite outcome.	-Forceps and ventouse application resulted in decreased risk of endometritis, wound complications but increased use of episiotomy and perineal lacerations compared to caesarean section.
Neonatal outcomes	Mean birth weight (p=0.027), low 5-minute APGAR score (p=0.046) more in caesarean section group. Other neonatal outcomes not different in both groups.	-Neonatal birth weight higher in caesarean section (p<0.001) -NICU admission 4.4% in instrumental delivery vs 5.6% in caesarean section.	No difference in neonatal composite outcome (death, fracture, low APGAR score, ventilator support).	Rate of neonatal composite outcome was significantly increased in vacuum extraction (27%) vs forceps (14.7%) vs caesarean section (9.7%).	-Forceps delivery was associated with significantly less Neonatal intensive care unit admission (5.6 vs.13.6% caesarean section), respiratory morbidity (1.7 vs. 6.6%), and sepsis (0.4 vs. 2.5%).

[Table/Fig-5]: Comparison of results of various studies in last ten years [9,11-13].

of labour is associated with extension of uterine incision, laceration of uterine vessels and higher chances of colporrhexis. These occur as a result of delivery of the impacted head which is technically difficult. Many methods and devices are available for delivery of impacted head at caesarean section and each requires adequate training and skill. Postpartum wound infection and febrile illness was more commonly seen following caesarean delivery in present study. The risk factors for post caesarean wound infection includes residence in rural area, gestational diabetes, hypertensive disorder, prolonged trial of labour prior to surgery, use of internal foetal monitoring, non use of prophylactic antibiotics and surgeries of longer duration [15]. Data regarding residence of study participants was not collected. Most of the patients attending this hospital come from rural areas. Also caesarean section in second stage is associated with longer operation time and longer mean hospital stay [16]. Surgery duration of more than one hour has been reported to increase the risk for surgical site infection more than two fold [17]. Postpartum febrile illness may be a result of endometritis, surgical site infection or due to blood transfusion. The risk of all these factors increases manifold with caesarean section at full cervical dilatation. According to a study conducted at a teaching hospital in eastern India, caesarean deliveries performed in the second stage were associated with longer operation time and increased need for blood transfusion, rates of wound infection, intraoperative complications, and need for transfer to intensive care unit [18]. Present findings were consistent with the available literature [19]. Severe lacerations in the form of third and fourth degree perineal tears were more in instrumental vaginal delivery group (19.2%). A similar study conducted showed severe lacerations were most common among forceps deliveries (33.8%), followed by ventouse deliveries (19.1%) and nil in caesarean section [20]. Instrument-assisted vaginal delivery, nulliparity and heavy newborn birth weight are historically the risk factors for third and fourth degree lacerations [21]. The major factor which determines the safety of the instrument is the operator rather than the instrument [6]. Forceps and ventouse can be used in the hands of a skilled operator with an appropriate level of expertise and this minimises complications.

The composite neonatal outcome was not different in both the groups except low 5-minute APGAR score (<7). It was more commonly seen in babies born by caesarean section (15.4%) than operative vaginal delivery (3.8%). Seal SL et al., found significantly low APGAR score at 5 minutes, increased neonatal death, admission to neonatal intensive care unit, increased need for intubation, septicaemia, neonatal seizures, and foetal injury (all having $p<0.05$) following caesarean section in second stage [12]. Another retrospective study conducted at Singapore showed no significant difference in 5-minute APGAR scores of neonates [11]. In present study, Sick Newborn Care Unit (SNCU) admission rate was more in instrumental vaginal delivery group. This was because of the practice of routinely sending babies delivered by forceps to SNCU for review. The possible reason for poor neonatal outcome in second stage caesarean section could be prolonged decision to delivery interval. Decision-to-Delivery Interval (DDI) and emergency caesarean section should not be more than 30 minutes, and a delay of more than 75 minutes in the presence of maternal or foetal compromise can lead to poor outcome [9]. In this study, the DDI was not evaluated. Future studies comparing ventouse, forceps, caesarean section and newer devices like odon device will further enhance the existing knowledge in this field.

Limitation(s)

The limitations of this study were small sample size and lack of randomisation. Scope of randomisation in this type of study is limited because of the ethical and legal aspects associated with it. As the initial study design was to compare instrumental vaginal delivery with caesarean section, data of normal vaginal delivery was not collected in this study. However, comparison between outcomes of vaginal delivery, instrumental delivery and caesarean section can be considered in another study.

CONCLUSION(S)

Caesarean section in second stage of labour causes increased maternal morbidity compared to instrumental vaginal delivery. Neonatal outcomes do not vary much in either modes of intervention. Forceps and vacuum extractors can be used as a substitute for caesarean section in selected cases in second stage of labour. In skilled hands these instruments can aid in smooth delivery of a healthy baby and can avoid the risks associated with second stage caesarean section. Nevertheless, in resource limited countries like ours, where the demand and supply are miles apart, traditional obstetric skills should be harnessed and passed on to generations of trainees to ensure the greater good of the society.

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