International Journal of Reproduction, Contraception, Obstetrics and Gynecology
Swain S et al. Int J Reprod Contracept Obstet Gynecol. 2017 Sep;6(9):4065-4070
www.ijrcog.org

pISSN 2320-1770 | eISSN 2320-1789

DOI: http://dx.doi.org/10.18203/2320-1770.ijrcog20174063

Original Research Article

Assisted delivery of mobile fetal head: a comparison of forceps, vaccum and assisted manual extraction of head at caesarean section

Sujata Swain*, N. Sagarika, Rabi N. Satpathy, Purna C. Mahapatra

Department of Obstetrics and Gynecology, S. C. B. Medical College Cuttack, Odisha, India

Received: 09 July 2017
Accepted: 05 August 2017

***Correspondence:**
Dr. Sujata Swain,
E-mail: sjt_swain@yahoo.co.in

ABSTRACT

Background: Difficult fetal extraction occurs in 1-2% of caesarean deliveries. Either forceps or a vaccum device is often used to assist in delivery of the fetal head in cesarean section in high floating/mobile fetal head. This study compare the safety (for mother and fetus) and efficacy of forceps and vacuum assisted delivery of high floating/mobile fetal head with the traditional method of manual extraction at caesarean section.
Methods: The sample size included 100 cases of LSCS with manual extraction of fetal head, 100 cases of LSCS with forceps assisted extraction of fetal head and 100 cases of LSCS with vacuum assisted extraction of fetal head.
Results: Application of fundal pressure was required in all cases of manual extraction group, in 51 cases of forceps extraction group. None of the cases of vacuum extraction group required application of fundal pressure. The U-D interval in manual extraction group was 90.56±4.91 seconds, in forceps extraction group was 70.2±5.02 seconds and in the vacuum extraction group it was 62.3±2.03 seconds. In the manual extraction group, there was an estimated blood loss of 428±69.38 ml, 579±97.22 ml of estimated blood loss was present in forceps extraction group and in the vacuum extraction group it was 454±66.92 ml.
Conclusions: This study reveals that with use of vacuum in CS for delivery of floating head, is superior than application of forceps and manual delivery in relation to time, blood loss and fundal pressure without any adverse effect on neonates and maternal complication.

Keywords: Caesarean Section, Forceps, High floating/mobile fetal head, U-D interval, Vacuum assisted delivery

INTRODUCTION

Cesarean section is the delivery of the viable fetus, placenta and membranes through an incision in the abdominal wall and the uterine wall. The estimated rate of CS is 15% worldwide during the past decade. A major technical problem of delivery by cesarean section is delivery of the fetal head through the uterine incision. Difficult fetal extraction occurs in 1-2% of cesarean deliveries.[1] Either forceps or a vacuum device is often used to assist in delivery of the fetal head in cesarean section when the delivery is difficult and where atraumatic manual delivery of fetal head is not possible.[2,3]

High floating or mobile fetal head may be a spontaneous unengaged fetal head or following disengagement of a deeply impacted head. It has been a traditional concept that engagement of fetal head occurs by 38 weeks of gestation in primigravida. However, in multigravida, engagement always occurs after the onset of labour or even late in first stage of labour following rupture of membranes. Unengagement of head in primigravida has long been considered a possible sign of cephalo pelvic disproportion.[4] The purpose of this study is to compare the safety (for mother and fetus) and efficacy of forceps and vacuum assisted delivery of high floating/mobile

fetal head with the traditional method of manual extraction at cesarean section.

METHODS

This prospective cross sectional analytical study was done in the Department of Obstetrics and Gynecology, Sri Ram Chandra Bhanja Medical College, Cuttack, Odisha. The study was conducted from December 2014 to June 2016 on 300 cases of cesarean sections presenting with high floating fetal head at term. The sample size included 100 cases of LSCS with manual extraction of fetal head, 100 cases of LSCS with forceps assisted extraction of fetal head and 100 cases of LSCS with vacuum assisted extraction of fetal head. After taking informed consent and reassuring patients regarding expertise and confidentiality, those with floating fetal head at term undergoing CS were grouped into 3 groups. Group M included 100 cases of manual extraction, Group F included 100 cases of forceps extraction and Group V included 100 cases of vacuum extraction of floating head during cesarean section. All mothers received spinal anesthesia. All deliveries were timed using stopwatches from the time of entry into the uterus (amniotomy or herniation of the fetal membranes through the fully transected lower uterine segment) until the full delivery of the fetal head.

Manual extraction of floating fetal head

The physicians were instructed to incise the lower uterine segment and fetal membranes in the typical manner using the scalpel blade and by using the bandage scissors or by digital expansion. For those deliveries by means of traditional manual extraction, the physician's hand was introduced into uterus. Fundal pressure was given and lifting the anterior uterine wall with fingers facilitated fetal head delivery. If delivery was not imminent after one attempt at manual delivery, then it was proceeded with delivery by using forceps blades.

Forceps assisted delivery of floating fetal head

Short curved obstetric outlet forceps were used for fetal head extraction. Once the hysterotomy had been performed, one of the blades was introduced depending on the side (to make locking easier) so that it lied against the cheek infront of the anterior ear. The placement of the blade was facilitated by putting one hand under the head and sliding the blade between the fingers and thus moving the fetal head into position and was fixed. The other blade was then applied directly by lifting the anterior uterine wall with fingers thus sliding the blade into place. The shanks were locked. The correct position of the forceps was checked by making sure that the sagittal suture was oriented transversely between the blades. Adjustments were made as needed. Then traction was applied, without rotation, along the long axis of the mother. Fundal pressure was used to assist extraction. While guiding the head out of incision the vertex was flexedby digital pressure on the bones converging at the posterior fontanelle.

Vacuum assisted delivery of floating fetal head

The vacuum system used in our study comprised of a vacuum cup communicating with a source of vacuum. A soft, silicone obstetric vacuum cup of diameter-6 cm (manufactured by Medisil Engineers, Iyyappanthangal, Chennai, Tamil Nadu) was used to evenly cover and adapt to the entire occiput and the individual fetal head contour. The hospital piped-vacuum supply with a vacuum regulator (SURGIX, High vacuum, MSYS007, Anand surgical industries, New Delhi, India) was used which required 300 mm Hg (5.5 lb/inch$^{2)}$ to develop the vacuum needed for ventouse delivery. This vacuum pressure was much less than the vacuum pressure used for assisted vaginal delivery(550-600 mm Hg).Reading off the vacuum was calibrated in Full Vacuum(300 mm Hg), before connecting the vacuum cup to this suction line.

After the uterine incision and membranes rupture, the vacuum cup was placed over the occiput. When previously applied clamp was removed, the suction was immediately available and the vacuum cup was attached to the head. Fifteen to twenty seconds after, traction was applied concurrently with gentle fundal pressure, pulling towards the middle of the uterine incision. Holding the instrument near the base of the vacuum cup and gentle fundal pressure was helpful for completion of the procedure. Following delivery of the head, the vacuum was discontinued and the cup was removed. About 100 mm Hg was sufficient to fix the cup to the fetal head.

Criteria for proper application of vacuum cup

The cup should be placed directly to fetal scalp as near the posterior fontanelle as possible and over the sagittal suture. The knob of the cup should be in the direction of the occiput. A finger is swept around the cup to ensure that no umbilical cord loops or any tissue is interposed between cup and head. Once vacuum is applied, the cup should not be twisted. During traction, pressure is applied with two fingers (thumb against the dome of the cup and index finger on the scalp in front of the cup) of the non-dominant hand over the cup to maintain it in firm contact with the head and prevent cup detachment.

Fetal head delivery technique (Manual/Forceps/Vacuum), U-D interval (by stopwatch), blood loss for the procedure (by suctioning) was estimated. Presence of any complication like extension of uterine incision, cervical laceration, PPH were noted.

The general condition of the infant was assessed by the attending pediatrician. Fetal outcomes in terms of birth weight, neonatal APGAR scores (at 1 minute and 5 minute), evidence of any neonatal trauma (including scalp abrasions, bruising, cephalohematoma, subgaleal or

intracranial hemorrhage) and need for neonatal resuscitation were observed.

Statistical analysis

The data were analyzed using the statistical software package. Statistical analysis included student t-test for continuous variables and chi-square test for categorical variables. Proportions were analyzed by z-test. Continuous data were analyzed and presented as Mean±Standard Deviation (SD) and categorical variables were presented as count. A p-value <0.05 was considered as statistically significant.

RESULTS

The total number of cases studied was 300. 32 cases (10.67%) were below 20 years of age. 258 cases (86%) were between 20 to 30 years of age and 10 cases (3.33%) were above 30 years of age.

Table 1: Comparison of mean maternal age among the groups.

Maternal age	Manual	Forceps	Vacuum
Mean	25.78	25.53	25.68
S.D.	3.27	2.99	3.01
P-value	0.581	0.725	0.834

The Maternal age in the manual extraction group was 25.78±3.27 years, in the forceps extraction group it was 25.53±2.99 years and in the vacuum extraction group it was 25.68±3.01 years.

Table 2: Comparison of maternal weight among study groups.

Weight (in Kg)	Manual	Forceps	Vacuum
Mean	64.98	65.56	64.95
S.D.	1.75	2.48	1.13
P-value	0.477	0.422	0.442

The maternal weight in the manual extraction group was 64.98±1.75 kg, in the forceps extraction group was 65.56±2.48 kg and in the vacuum extraction group it was 64.95±1.13 kg. The maternal height in the manual extraction group was 1.51±0.04 m, in the forceps extraction group was 1.56±0.01 m and in the vacuum extraction group it was 1.54±0.02 m.

Table 3: Comparison of BMI among the study groups.

BMI (Kg/m^2)	Manual	Forceps	Vacuum
Mean	28.39	26.87	27.27
S.D	2.04	0.64	0.58
P-value	0.339	0.470	0.391

The BMI in the manual extraction group was 28.39±2.04 Kg/m^2, in the forceps extraction group was 26.87±0.64 Kg/m^2 and in the vacuum extraction group it was 27.27±0.58 Kg/m^2.

Table 4: Gestational age.

GA (in weeks)	Manual	Forceps	Vacuum
Mean	39.04	38.84	38.63
S.D.	0.51	0.50	0.43
P-value	0.422	0.431	0.422

The gestational age in the manual extraction group was 39.04±0.51 weeks, in the forceps extraction group was 38.84±0.50 weeks and in the vacuum extraction group it was 38.63±0.43 weeks.

Table 5: Apparent etiology of non-engagement.

Apparent etiology of nonengagement	No. of cases	%
Deflexed head	84	28
Cephalo pelvic disproportion	60	20
Loops of cord around neck	15	5
Prelabour rupture of membranes	12	4
No cause found	129	43
N	300	100

No apparent etiology of non-engagement was found in 129 cases (43%). Among the known causes, deflexed head was most commonly found to be present in 84 cases (28%), followed by cephalopelvic disproportion in 60 cases (20%), loops of cord around neck in 15 cases (5%) and prelabour rupture of membranes in 12 cases (4%).

Application of fundal pressure was required in all cases of manual extraction group. In 51 cases of forceps extraction group, application of fundal pressure was required and 49 cases did not require it. None of the cases of vacuum extraction group required application of fundal pressure. The U-D interval in manual extraction group was 90.56±4.91 seconds, in forceps extraction group was 70.2±5.02 seconds and in the vacuum extraction group it was 62.3±2.03 seconds. Extension of uterine incision was required in 12 cases belonging to the manual extraction group and 4 cases belonging to the forceps extraction group. None of the cases belonging to the vacuum extraction group required extension of uterine incision.

In the manual extraction group, there was an estimated blood loss of 428±69.38 ml, 579±97.22 ml. of estimated blood loss was present in forceps extraction group and in the vacuum extraction group it was 454±66.92 ml. The birth weight in the manual extraction group was 3.03±0.21 kgs, in the forceps extraction group was 2.95±0.16 kgs and in the vacuum extraction group it was 2.93±0.17 kgs. APGAR scores at 1 min was between 4 to 7 in 2 cases each in the manual, forceps groups the APGAR scores at 1 min was >7. The APGAR scores in Manual extraction group was 8. vacuum extraction groups. In 98 cases each in the manual, forceps and

vacuum extraction 47±0.54, in forceps extraction group was 8.45±0.57 and in the vacuum extraction group it was 8.6±0.53. In all cases of the manual, forceps and vacuum extraction groups the APGAR score at 5 min. was >7. The APGAR score in manual extraction group was 8.49±0.50, in the forceps extraction group was 8.53±0.50 and in the vacuum extraction group it was 8.61±0.49.

DISCUSSION

In the present study, there was no significant difference in the mean maternal age between Manual extraction and forceps extraction group (P=0.581), between Forceps extraction and Vacuum extraction group (P=0.725) and between Manual extraction and Vacuum extraction group (P=0.834). In the study done by Sritippayawan S et al, they observed no significant difference between the two groups (P=0.194) (Table 1).[11]

There was no significant difference in the maternal weight between the manual and forceps extraction groups (P=0.477), between the forceps and vacuum extraction groups (P=0.422) and between the manual and vacuum extraction groups (P=0.422).

Comparable to the study done by Sritippayawan S et al no significant difference between the two groups (P=0.864) (Table 2).[3]

In the present study, there was no significant difference in BMI between the Manual extraction and Forceps extraction group (P=0.339), between the Forceps extraction and Vacuum extraction group (P=0.470) and between the Manual extraction and Vacuum extraction group (P=0.391) (Table 3).

Study done by Arad I et al and Banu F et al showed that there was no significant difference in gestational age between the two groups.[5,6]

In the present study, there was no significant difference in gestational age between manual and forceps extraction groups (P=0.42), between forceps and vacuum extraction groups (P=0.43) and between manual and vacuum extraction groups (P=0.42) (Table 4).

No apparent etiology of nonengagement was found in majority of cases studied by Ambwani B et al, Iqbal, S. et al and Nadia K et al.[4,7,8] No apparent etiology of nonengagement was found in the present study in majority of the cases (43%) (Table 5).

In the study done by Arad I et al the U-D interval in the manual extraction group was 40.9±9.8 seconds and in the Vacuum extraction group it was 79.4±10.2 seconds.[5] Sritippayawan S et al found the U – D interval in the manual extraction and vacuum extraction group to be 86.3±53.9 seconds and 65.3±31.2 seconds respectively.[2] The U-D interval in the manual and vacuum extraction group was 43.5±8.6 seconds and 75.6±9.02 seconds respectively, in the study done by Banu F et al.[6] The difference in U-D interval was found to be significant in the studies done by Arad I et al (P<0.01), Sritippayawan, S et al (P<0.001) and Banu F et al (P≤0.0001).

Table 6: Comparison of U-D interval.

U – D interval (Mean±SD) (Seconds)	M group	F group	V group	P - value
Arad I et al	40.9±9.8	-	79.4±10.2	< 0.01
Sritippayawan S et al	86.3±53.9	-	65.3±31.2	<0.001
Banu F et al	43.5±8.6	-	75.6±9.02	<0.0001
Present study	90.56±4.91	70.2±5.02	62.3±2.03	0.04, 0.22 and 0.01

In the present study, we found the U-D interval in the manual extraction group as 90.56±4.91 seconds, in the forceps extraction group as 70.2±5.02 seconds and in the Vacuum extraction group it was 62.3±2.03 seconds. The difference in U-D interval was significant (P=0.04) between manual extraction and forceps extraction groups. There was significant (P=0.01) difference in U-D interval between Manual and Vacuum extraction groups. No significant (P=0.22) difference was observed in the U-D interval between the forceps and vacuum extraction groups (Table 6).

There was a significant difference in the estimated blood loss between the manual and forceps extraction group (P=0) and between the forceps and vacuum extraction group (P=0). The difference in estimated blood loss between the manual and vacuum extraction groups was not significant (P=0.99) (Table 7).

Table 7: Comparison of extension of uterine incision.

Extension of uterine incision	M group	F group	V group
Ross W et al	16%	-	0%
Banu F et al	13%	-	7.1%
Poordast T et al	7.5%	-	7.7%
Present study	12%	4%	0%

Percentage of cases, in the present study, who had extension of uterine incision in manual extraction group

was similar to that of the study done by Ross W et al and Banu F et al.[10] Similar to the study by Ross W et al, no case in the vacuum extraction group in our study had extension of uterine incision. There was no significant difference in the estimated blood loss between the manual and vacuum extraction groups (P=0.99). This was similar to the study of Sritippayawan S et al (Table 8).

Table 8: Comparison of estimated blood loss.

Estimated blood loss (Mean ±SD) (ml)	M group	F group	V group	P-value
Sritippayawan S et al	504.4±204.9	-	576.7±182.9	0.306
Present Study	428.0±69.38	579.0±97.22	454.0±66.92	0, 0 and 0.99

Table 9: Comparison of APGAR score at 1 min.

APGAR Score at 1 min	M group	F group	V group	P - value
Arad I et al	8.5±0.3	-	7.6±0.7	N.S.
Banu F et al	5.83±1.20	-	5.67±1.12	0.26
Present study	8.47±0.54	8.45±0.57	8.6±0.53	0.80, 0.07 and 0.09

No significant difference in birth weight was present between manual and forceps extraction groups (P=0.999), between forceps and vacuum extraction groups (P=0.890) and between manual and vacuum extraction groups (P=1), which is similar to the study of Arad, Sritippayawan and Banu.

There was no significant difference in APGAR scores at 1 min between the manual and forceps extraction groups (P=0.804), between the forceps and vacuum extraction groups (P=0.070) and between the manual and vacuum extraction groups (P=0.096) which is similar to the findings of Arad and Banu (Table 9).

Table 10: Comparison of APGAR score at 5 min.

APGAR Score at 5 min	M group	F group	V group	P-value
Arad I et al	9.7±0.2	-	9.9±0.1	N.S.
Banu F et al	7.59±0.83	-	7.48±0.99	0.29
Present study	8.49±0.50	8.53±0.50	8.61±0.49	0.55, 0.20 and 0.07

Table 11: Comparison of fetal outcomes among study groups.

Fetal outcome	Manual	Forceps	Vacuum
Scalp injury	0	2	0
Meconium aspiration	0	0	0
Neonatal resuscitation	73	75	70
Admission to SNCU	4	1	1
Convulsion	0	0	0
Any intracranial haemorrhage	0	0	0
Early neonatal death	0	0	0

Similar to the findings of Arad and Banu, in the present study, the difference in the APGAR score at 5 min was not significant between the manual and vacuum extraction groups (P=0.07) (Table 10).

Similar to the study of Sritippayawan S et al and Poordast T et al, there was no Scalp injury in the manual and vacuum extraction groups in the present study (Table 11).[2,9]

Other intra-operative parameters such as failure, difficulty and switchover to other method of fetal head extraction were also studied. With proper application of forceps blades no such problem was faced. Similarly, with the soft silicone cup and hospital supplied vacuum regulator no pop-off of vacuum cup was observed. Post-op maternal and neonatal outcomes were observed and no major morbidities were reported in subsequent follow up after 6 weeks.

CONCLUSION

This study reveals that with use of vacuum in CS for delivery of floating head, is superior than application of forceps and manual delivery in relation to time, blood

loss and fundal pressure without any adverse effect on neonates and maternal complication With appropriate training, available soft silicone vacuum cup (preferable) can be valuable tools in the armamentarium of the practicing obstetric care providers to effect safe and effective method of delivery of high floating head at CS.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Swain S, Sagarika N, Satpathy RN, Mahapatra PC. Assisted delivery of mobile fetal head: a comparison of forceps, vaccum and assisted manual extraction of head at caesarean section. Int J Reprod Contracept Obstet Gynecol 2017;6:4065-70.