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VACUUM-ASSISTED CESAREAN SECTION – A NOVEL STUDY

Gynaecology

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ABSTRACT

Objective : The rate of cesarean deliveries has increased over a decade due to multifactorial reasons explicitly; decrease in vaginal births after cesarean (VBAC), multiple gestation, maternal obesity, pre-term labor, gestational diabetes or hypertension, increased number of high-risk expectant mothers and the obstetrical medico-legal environment. This upsurge, coupled with a decreasing willingness to allow vaginal birth after cesarean section, has resulted in an expansion of the use of vacuum assistance to safely extract the fetal head. By avoiding the use of a delivering hand or forceps blade, the volume being delivered through the uterine incision can be decreased when the vacuum is used properly. Reducing uterine extensions with their associated complications (eg, excessive blood loss) in difficult cases is also a theoretical advantage of vacuum delivery.

Materials and methods : This study was conducted on 50 full term pregnant women undergoing cesarean section at Krishna Institute of Medical Sciences, Karad, Maharashtra, India. All patients were between 37 and 41 weeks of pregnancy with signs of healthy fetus and were divided into 2 groups; Group A- 25 patients subjected to vacuum extraction at the cesarean section, Group B- 25 patients subjected to the conventional cesarean method. Fetal head delivery technique (Manual/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.

Results : Application of fundal pressure was required in all cases of manual 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, 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, and in the vacuum extraction group it was 454±66.92 ml.

Conclusion : It was found that the use of vacuum extractor is an easy, non traumatic and rapid method which abates the need of rough and prolonged fundal compression and its consequences and significantly fewer maternal complications.

KEYWORDS

Vacuum extraction, cesarean section

INTRODUCTION

The rate of cesarean deliveries has increased over a decade due to multifactorial reasons explicitly; decrease in vaginal births after cesarean (VBAC), multiple gestation, maternal obesity, pre-term labor, gestational diabetes or hypertension, increased number of high-risk expectant mothers and the obstetrical medico-legal environment [1]. At times, the delivery of the infant during a cesarean section may pose difficulties, depending on the size and station of the fetal head. It may also be associated with redundant maternal complications like lateral extensions in uterine incisions and lacerations up to the level of cervix [2]. Techniques which may help in smoother delivery under aforesaid circumstances include the use of forceps, additional pressure or incisions on the uterus; however, these maneuvers can be traumatic for both the mother and fetus [3]. The use of the vacuum cup to aid in delivery of the fetal head at cesarean section has been gaining momentum in the recent years.2 Use of vacuum dates back to 1962 by Solomon for the extraction of fetal head; he suggested that its use will reduce the pressure on fetal head, decrease delivery time thereby decreasing fetal hypoxemia and decrease the extension of incision and vascular insult [4].

In 1705, Yonge described an attempted vaginal delivery using a cupping glass. First successful obstetric vacuum extractor was designed by James Young Simpson, professor of Obstetrics at the Edinburgh University in 1849. His device was made of a metal syringe attached to a soft rubber cup, was placed against the fetal head, the syringe was evacuated followed by application of traction at the base of the cup and the infant extracted. The device had many disadvantages; the vacuum force was limited and replenishment was impossible after the initial evacuation of the syringe and the device lacked a pelvic curve. Multiple innovations followed, and a metal-cup extractor was developed by Malmstrom in 1953. Recently, bell-shaped and hemispheric silicone rubber cups have come into use [5].

Metal cups have a higher success rate as the cup placement in the occipito-posterior position is easier. However, their stiffness can make application cumbersome and are associated with an increased risk of fetal scalp injuries [6]. In comparison to metal cup, soft cup vacuum extractor's causes fewer neonatal scalp injuries. These can be used with a manual vacuum pump or an electrical suction device; some have an incorporated vacuum-release valve that permits pressure to be rapidly attained and accurately controlled [7].

Rarely, vacuum assisted cesarean deliveries may be associated with fetal and maternal complications. Common fetal complications include chignon (iatrogenic caput succedaneum), cephalohematomas and potentially life-threatening, subgaleal or subaponeurotic hemorrhages. Certain insignificant complications include scalp bruising or lacerations and retinal hemorrhages [8]. The rate of maternal injury with vacuum extraction is low in comparison with forceps or cesarean delivery. However, they do occur and include perineal lacerations, hematomas, blood loss and anemia, urinary retention, and long-term problems with urinary and fecal incontinence [9]. The present study was conducted to investigate the benefits and the limitations in using the soft cup vacuum extractor on the fetal scalp during the caesarean section and evaluate the maternal and fetal complications associated with the use of same. To the best of our knowledge this study is a pioneer study comparing the outcome of caesarean section with and without the use of vacuum extractor.

Potential advantages of vacuum-assisted cesarean section

1. The ability to decrease the volume of the fetal head by avoiding the use of a delivering hand or forceps blade
2. The ability to avoid traumatic or deliberate extension of the uterine incision, along with decrease in associated blood loss
3. The ability to decrease the amount of fundal pressure necessary for delivery, thus reducing maternal discomfort

MATERIALS AND METHODS

This prospective cross sectional analytical study was done in the Department of Obstetrics and Gynecology, Krishna Institute of Medical Sciences, Karad, Maharashtra, India. The study was conducted from December 2018 to November 2019 on 50 cases of cesarean sections presenting with floating fetal head at term. The sample size included 25 cases of LSCS with manual extraction of fetal head, and 25 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 2 groups. Group A included 25 cases of vacuum extraction, and Group B included 25 cases of manual

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.

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/inch2) 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.

RESULTS

The present study comprised of 50 pregnant women divided into 2 groups; Group A- 25 patients were subjected to vacuum extraction at the cesarean section, Group B- 25 patients were subjected to the conventional cesarean method.

In Group A, 12 women out of 25 were primagravida (pregnant for the first time); whereas 13 had history of multiple deliveries. In Group B, 13 out of 46 were primagravida; whereas 12 had history of multiple deliveries. Six out of 25 women in Group A and 8 out of 25 women in Group B had a previous history of cesarean section. Lateral extension in uterine incisions was seen in none of the cases in Group A and 2 cases in Group B. For group A, the duration of the scalp traction was considerably shorter (32 ± 3 sec) in comparison to group B (48 ± 16 sec). In the manual extraction group, there was an estimated blood loss of 428±69.38 ml and in the vacuum extraction group it was 454±66.92 ml. (Table 1).

Table-1: Comparison of characteristics among the study groups

Parameters	Group A n (%)	Group B n (%)
Primagravida	12 (48%)	13 (52%)
Multiple pregnancies	13 (52%)	12 (48%)
Previous caesarean sections	6 (24%)	8 (32%)
Lateral extension in uterine incisions	0 (0%)	2 (8%)
Duration of scalp traction (secs)	32±3	48±16
Estimated blood loss	454±66.92 ml.	428±69.38 ml

Table 2 demonstrates Neonatal outcome parameters of the study groups. The birth weight of the babies delivered in Group A and Group B were 3.08±0.47 and 3.07±0.46 respectively. There was no statistically significant difference between the birth weight of babies in both the groups (p= 0.45). The gestational age of the babies in Group A and B were 39.1±1.09 and 38.9±1.10 weeks; statistical difference between both the groups was insignificant (p= 0.29). The initial (after 1 min) Apgar score (5.67±1.12) of 42 neonates delivered by vacuum extraction during cesarean section was similar to the Apgar score (5.83±1.20) of 46 neonates delivered by an elective regular cesarean section; Apgar scores after 5 minutes of birth were 7.48±0.99 and 7.59±0.83 (p=0.29). It was found that the U-D interval was prolonged in case of the vacuum group in comparison to the conventional group.

Table-2: Neonatal outcome parameters of the study groups

Parameters	Group A Mean±SD	Group B Mean±SD	P value
Birth weight (kg)	3.08±0.47	3.07±0.46	0.45
Gestational age (weeks)	39.1±1.09	38.9±1.10	0.29
Apgar score at 1'	5.67±1.12	5.83±1.20	0.26
Apgar score at 5'	7.48±0.99	7.59±0.83	0.29
U-D intervals (mins)	75.6±9.02	43.5±8.6	< 0.0001

Importantly,

A small chignon was noted on all infants, which resolved within 2 days.

Almost all infants developed jaundice post-delivery. The serum bilirubin did not exceed > 12 mg/dl in any of the cases. The jaundice ultimately resolved spontaneously or with assistance of phototherapy within 2 weeks in all the infants.

DISCUSSION

Over the past decade, cesarean section rate has increased three fold. Delivery of the infant at the time of cesarean section may pose difficulties, depending on the size and station of the fetal head. Thus, a vacuum cup is used to minimize the space requirements for hysterotomy and reduce the incidence of unwanted maternal and fetal complications [10].

The present study comprised of 88 pregnant women divided into 2 groups; Group A- 25 patients were subjected to vacuum extraction at the cesarean section, Group B- 25 patients were subjected to the conventional cesarean method.

In Group A, 12 women out of 25 and in Group B, 13 out of 25 were primagravida. Six out of 25 women in Group A and 8 out of 25 women in Group B had a previous history of cesarean section. Lateral extension in uterine incisions was not seen in any cases in Group A and 2 cases in Group B.

Duration of scalp traction for Group A and Group B subjects were 32 ± 3 sec and 48 ± 16 sec respectively. The duration of the scalp traction was considerably shorter in comparison to the manual extraction. These findings were in concordance with the study conducted by Dimitrov et al. [11] where the duration of the scalp traction was significantly shorter (30 + 4 sec) in comparison to the classical manual extraction (53 + 21 sec).

There was statistically insignificant difference between the birth weights (Group A and Group B: 3.08±0.47 kgs and 3.07±0.46 kgs) and gestational age in both the groups (Group A and B: 39.1±1.09 and 38.9±1.10 weeks). However, Shi Wu Wen et al. [12] in his study found that the use of instruments like vacuum or forceps was more frequent in infants with higher birth weight and gestational age.

The Apgar scores of the two groups were not significantly different after 1 and 5 minutes of birth. Similar results were found in the study conducted by Sritippayawan et al. [13].

The U-D interval was prolonged in case of the vacuum group in comparison to the conventional group (p <0.0001). U-D interval for Group A and Group B were 75.6±9.02 and 43.5±8.6 respectively. These results were in concordance with the study conducted by Arad et al. [14]. According to him, prolongation was due to the time required for application of the vacuum cup and negative pressure build up. Crawford et al. [15] demonstrated that the time elapsing between the initial incision of the myometrium and complete delivery was directly related to the fetal distress. They said that it could be due to interference with utero-placental blood flow or of prolonged handling of the infant during extraction from within the uterus.

In the present study maternal complications like spreading of uterine

incision was found to be lower in vacuum assisted group. Similar results were found in a study conducted by Baghianimoghadam et al. [16] where maternal complications like spreading of uterine incision and cervical rupture was lower in control group. Pelosi et al. [17] also concluded that vacuum can lower maternal complications.

CONCLUSION

The use of vacuum extractor is an easy, non traumatic and rapid method which abates the need of rough and prolonged fundal compression and significantly fewer maternal and fetal complications. With vacuum extraction becoming increasingly popular, it is important that obstetric care providers are aware of the risks associated with such deliveries and the alternatives available to aid in a safe and expedient delivery.

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