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Vacuum Assisted Vaginal Delivery: Prevalence, Indication, Fetal, Maternal Outcomes at Temeke Hospital Dar es Salaam: Descriptive Cross-Sectional Study

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ABSTRACT

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Background: Vacuum extraction delivery is instrumental assisted vaginal delivery performed for maternal or fetal reasons. Practitioners prefer to perform it rather than other methods of assisted vaginal delivery because it is easy to use, requires less anesthesia/analgesia and safer than other methods. A support from (CCBRT) in Tanzania, training on vacuum-assisted deliveries has been conducted to health providers at Temeke Regional Referral Hospital and equipment supplied for carrying out the procedure.

Aim: To determine the prevalence and describe maternal and fetal outcomes of vacuum-assisted vaginal deliveries (VAVD) at Temeke Hospital in Tanzania

Method: A descriptive cross-sectional hospital-based study was conducted at Temeke Referral Hospital in Dar-es-salaam, Tanzania. All women who met inclusion criteria were involved in getting 247 women delivered by vacuum-assisted vaginal delivery from June to December 2017. Data on demographic characteristics, maternal and fetal outcomes were collected by registered nursing officers/midwives using a checklist, analyzed by SPSS, and summarized using frequency distributions and charts.

Result: Two hundred forty-seven women, were identified to have undergone vacuum-assisted vaginal delivery during the study period, (60.7%) of them had reached 39-40 weeks of gestation. Maternal exhaustion, followed by delayed second stage of labor was an indication of VAVD at 42.1% and 25.5% respectively. 96.3% of the newborns weighed 2.5-4.0 kilograms. Apgar score was 7 to 10 at 5 minutes. Of 5,400 deliveries, the prevalence of the vacuum-assisted deliveries was 4.57%. Successful cases were 97.2% with failure rate of 2.8%.

Conclusion: The use of Vacuum Assisted vaginal delivery was reported to be 4.57% with preponderance in multiparous women. The rate of vacuum-assisted deliveries increased due to efforts of CCBRT at Temeke Hospital to train middle cadres, provision of equipment and facilities for the purpose. The method if properly supervised and conducted, can benefit pregnant women, reduce maternal, neonatal morbidity and mortality.

KEYWORDS:

Vacuum Assisted Vaginal Delivery

BACKGROUND

Vacuum assisted vaginal delivery is one of the interventions used to reduce life-threatening complications for mothers and their babies (Hafeez, Badar & Yasin, 2013; Baskett, Fanning & Young, 2008). The principle idea of the vacuum extractor is to use a cup device attached by tubing to a pump to create enough negative pressure to allow traction on the cup, thus transferring the traction to the fetal scalp which is thereby pulled along the birth canal axis. Traction is applied during uterine contraction, resulting in descent of fetal head by a push-pull effect. Vacuum extractor offers an immediate benefit of reducing several maternal injuries and very low fetal risk if it is performed by expert hands. If this procedure is performed correctly, the success rate of vacuum delivery should increase, the complications decrease, and the litigation associated with assisted deliveries should also decrease (Izzat, Haq & Kazi, 2013).

Vacuum assisted vaginal delivery is a procedure known to

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have existed for more than two centuries and has undergone various modifications and refinements. It is commonly used to expedite birth for the benefit of the mother and the baby. In order to prevent maternal and perinatal morbidity and mortality, vacuum assisted vaginal delivery can be used to accelerate vaginal delivery in cases of fetal distress in the second stage of labor, prolonged second stage of labor with poor maternal effort, and maternal medical conditions requiring shortening of the second stage of labor (Khalil& O'brien, 2016; Ilesanmi et al., 2003; Callahan, 2013; Bailey et al., 2017). The safe application of vacuum assisted delivery relies on strict following of guidelines for the procedure, appropriate case selection and judgement, good skills and experience and mastery of the equipment (Odoi & Opare-Addo, 2002).

Despite the many advantages vacuum assisted delivery has and being declared the method of choice in modern obstetric practice in averting maternal and neonatal mortality and morbidity (Ali, 2009; Hehir et al., 2013), its use is still limited in sub-Sahara African countries (Bailey et al., 2017; Ameh & Weeks, 2009). This low rate of use of vacuum assisted deliveries in sub-Saharan Africa and other developing countries has been attributed to lack of trained human resources, equipment and training (Nolens et al., 2016; Bailey et al., 2017) and also providers' beliefs that vacuum extraction can cause trauma to the baby and fear of HIV transmission (Nolens et al. 2016; Ameh & Weeks, 2009).

METHODS

Study Design

The study employed a descriptive cross-sectional design.

Study Setting

Temeke Regional Referral Hospital (TRRH) is a referral health facility located in Temeke District in Dar es Salaam, Tanzania. It has 5 departments which are; Obstetrics and Gynaecology, Pediatrics, Surgery, Internal medicine and Emergency medicine. Obstetrics and Gynaecology department has four wards; Antenatal ward with a capacity of 12 beds, labour ward with 20 beds, Post-surgeryl ward with 10 beds, Postnatal ward with 30 beds, Gyanaecology ward has 12 beds and 8 beds in Intensive Care Unit (ICU). Regarding staff working in Obstetrics and Gynaecology department at TRRH, there are 3 specialist doctors, 8 medical officers (Registrars), 6 internship doctors, 6 nursing officers, 12 assistant nursing officers, 8 enrolled nurses and 6 nursing attendants.

Women delivering at TRRH are either self-referred or referred from other lower health facilities within and outside the district. Most of deliveries are performed by medical officers (registrars), nursing officers/midwives who work in the labour ward. Decison making to perform vacuum assisted vaginal delivery is decided by a doctor on call or senior midwife incharge. When a problem arises and an expert opinion is required in management of the patient, a specialist doctor on call is called for intervention. On average, a total of forty deliveries are performed in a day and of these, 1-2 are vacuum assisted vaginal deliveries are performed per day, which is approximately 40 deliveries per month.

In 2014 CCBRT organized a training program which is ongoing at Temeke Referral hospital. The program aims at reducing maternal and fetal complications, number of women undergoing caesarean section and also referrals to Muhimbili National Hospital (MNH). According to TRRH labour ward database records, before this training referrals to MNH were between 12 to 15 per day, as compared to the current 4 to 5 per day. Caesarian section cases have also been reduced from 12 to 6 per day. Low score cases decreased from 8 to 2. CCRBRT provides training and supervision to doctors and nurses and also provide equipment to use for vacuum vaginal extraction. Before this training, doctors were the only ones who could perform vacuum vaginal extraction, however at the moment both trained doctors and nurses who succeeded to perform 5 supervised vacuum vaginal extraction in the department of obstetrics and gynecology can perform the procedure.

Study Population

The study population used records of all women delivered at Temeke Referral Hospital between June and December 2017

Inclusion criteria

All women delivered at TRRH from June 2017 to December 2017 were included.

Sample size

The sample size was determined using the formula (Cochran, 1963):

$n = Z_{\alpha/2}*pq/\varepsilon^2$

Where:

n = minimum sample size;

$Z_{\alpha/2}$ = standard normal deviate at 95% confidence (1.96)

p = the proportion maternal complications (17.1% according to Yakasai et al. 2015 in Uganda)

q = p-1 = 82.9%

ε = margin of error at 95% confidence interval (0.05).

Thus, the minimum estimated sample size was:

n = 3.84*17.1*82.9/25 = 218.

Adding 10% for missing/poor records, the minimum sample size was 240 vacuum-assisted deliveries.

Sampling Technique

All women who delivered at TRRH and who met the inclusion criteria were employed to get the study sample. All deliveries meeting the inclusion criteria, that is, deliveries performed by vacuum extraction, was consecutively be included in the sample.

Data Collection

Two research assistants who are registered nursing officers/midwives, employed at TRRH and preferably working in the labour ward and/or in the obstetrics and gynecology department were recruited and trained by the Principal Investigator (PI). The training dwelt on the purpose

of the study and how to collect the data using the a structured checklist. To pilot their proficiency in filling the questionnaire, previous records of vacuum-assisted vaginal deliveries were used. Data collected from records (delivery books and patient files) of vacuum-assisted deliveries comprised of patient's age, gravidity, parity, estimated gestation age, and Information about labor from the partograph. Other information included, Apgar score at 5 minutes, still birth, need of resuscitation, admission to Intensive Care Unit (ICU) for the mother and/or newborn, immediate maternal outcome, amount of blood loss, blood transfusion, anesthetic complication, perineal tear, maternal and neonatal deaths and the reasons, and other arising complications both to the mother and the newborn. Also data on the cadre of healthcare provider involved in performing the vacuum-assisted vaginal delivery were captured.

Data analysis

Collected data was entered in the computer and analyzed using Statistical Package for Social Sciences for Windows version 21 program (SPSS Inc., Chicago, IL. USA). Categorical data was presented using frequency distributions and charts. Numerical data was summarized using descriptive statistics (mean, median, standard deviation).

RESULTS

Socio-demographic Characteristics

Two hundred forty-seven women were identified to have undergone vacuum-assisted delivery during the study period. Majority of women (78.9%, n=189) were aged between 20 and 35 years. Age range was 16-41 years. Nearly half (49.4%) were either married or co-habiting and engaged in house work (48.2%). Nearly 90% had either primary (44.5%) or secondary (43.7%) education. More than three quarters (75.7%) were residing in urban settings (Table1).

Table 1: Socio-demographic characteristics of women undergoing vacuum-assisted deliveries (n=247)

Variable	No. (%)
Age (years):	
Younger than 20	35 (14.2)
20 - 35	195 (78.9)
36 - 41	17 (6.9)
Marital status:	
Single	97 (39.3)
Married/co-habiting	122 (49.4)
Divorced/separated/widowed	28 (11.3)
Education level:	
Informal	10 (4.1)
Primary	110 (44.5)
Secondary	108 (43.7)
Post-secondary	19 (7.7)
Occupation:	
House work	119 (48.2)
Business	96 (38.9)
Formal employment	27 (10.9)
Peasant/farmer	5 (2.0)
Residence:	
Rural	60 (24.3)
Urban	187 (75.7)

Obstetric characteristics

Table 2 shows the obstetric characteristics of women who underwent vacuum-assisted deliveries. Among 247 women, majority (53.4%) were multiparous. At the time of delivery, majority of the women (60.7%) had reached 39-40 weeks of gestation. For majority of the women the length of the second stage of labour was less than 1 hour.

Table 2: Obstetric characteristics of women who underwent vacuum-assisted deliveries (n=247)

Variable	No. (%)
Gravidity:	
1 - 3	211 (85.4)
More than 3	36 (14.6)
Parity:	
Nulliparous	115 (46.6)
Multiparous	132 (53.4)
Gestation age at delivery (weeks):	
37 - 38	77 (31.2)
39 - 40	150 (60.7)
41 - 42	20 (8.1)
Labour status (2nd stage) (hours)	
Less than 1	158 (64.0)
1 or more	89 (36.0)

Foetal characteristics

The mean birth-weight of neonates delivered by vacuum-assisted delivery was 3.1 kilograms, ranging from 2.3 to 4.5 kilograms. Majority of the newborns weighed 2.5-4.0 kilograms (96.3%). Apgar score was 9.6 ranging from 7 to 10 at 5 minutes. Table 3 shows the results.

Table 3: Foetal characteristics of neonates delivered by vacuum-assisted delivery (n=247)

Variable	No. (%)
Birth weight (kg):	
Less than 2.5	3 (1.2)
2.5 – 4.0	238 (96.4)
More than 4.0	6 (2.4)
Apgar score:	

7 – 10 at 5 Minutes	247 (100.0)

Prevalence of VAD

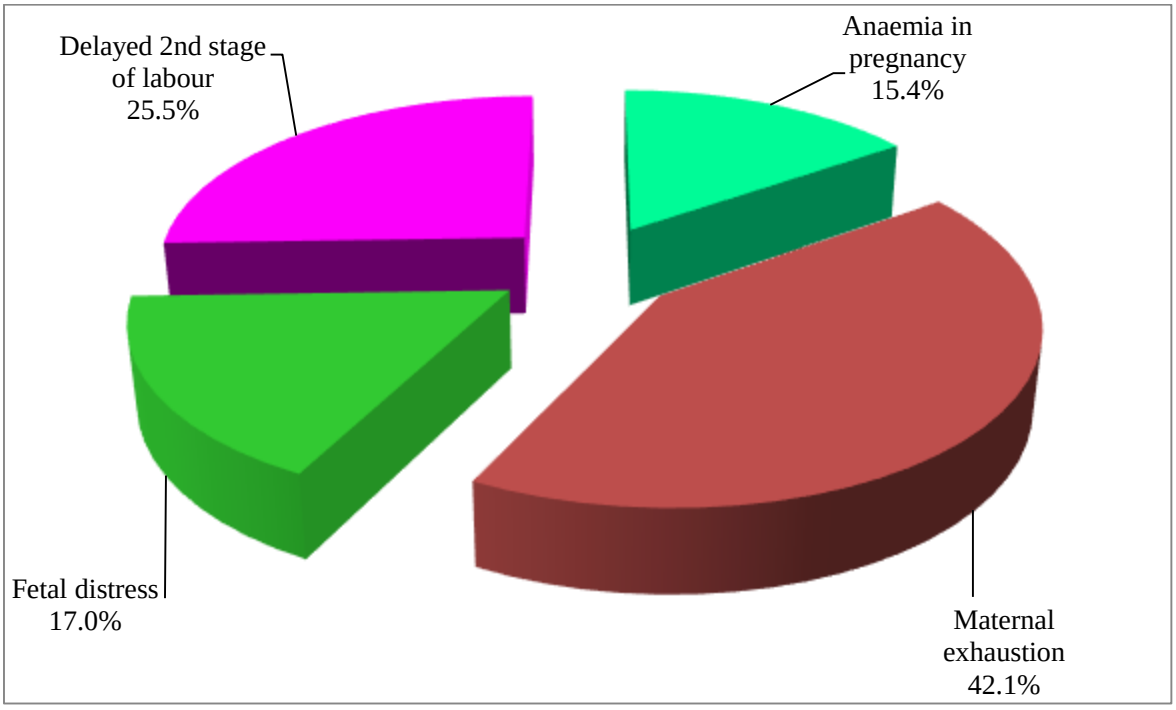
During the study period, 5,400 deliveries were performed at TRRH. The prevalence of vacuum-assisted deliveries was 4.57% (that is, 247 out of 5,400). Vacuum-assisted deliveries were successful in 97.2% cases with a failure rate of 2.8%).

Main reason for stopping VAD was the baby's head not delivered after three traction-aided contractions.

Indications of vacuum-assisted deliveries

About (42.1%) of women had maternal exhaustion as indication for vacuum-assisted delivery, followed by delayed second stage of labour and fetal distress with 25.5% and 17% of women respectively. The least common indication was anaemia in pregnancy (15.4%) (Figure 1).

Figure 1: Distribution of indications of vacuum-assisted deliveries at TRRH (n=247)



Maternal outcomes

Table 4: Distribution of maternal outcomes of successful vacuum-assisted deliveries (n=247)

Maternal outcome	No. (%)
Vaginal lacerations	155 (64.6)
Perineal tear:	145 (60.4)
1st degree	*17 (11.7)*
2nd degree	*31 (21.4)*
3rd degree	*29 (20.0)*
*Episiotomy**	*79 (54.5)*
Cervical tear	32 (13.3)
Postpartum haemorrhage	29 (12.1)

*9 mothers had any degree of perineal tear also had episiotomy

Neonatal outcomes

No complication was observed in neonates. Neither scalp abrasion nor cephalohematoma were seen in any of the neonates. Apgar score at 5th minute ranged from 7-10. None of the neonates delivered after failed VAD were admitted in NICU.

DISCUSSIONS

Assisted vaginal delivery (AVD) offers the option of an operative procedure to safely and quickly remove the infant, mother and obstetrician from a difficult or even hazardous situation. When spontaneous vaginal delivery does not occur within a reasonable time, a successful AVD or operative vaginal delivery trial avoids caesarean delivery with its attendant uterine scar and implications for future pregnancy and avoids potential birth asphyxia from prolonged fetal and cord compression (Lindow, 2018)

Prevalence of vacuum-assisted deliveries (VAD) was relatively high compared to reports from other studies in low- and middle-income countries. The common indications of VAD were found to be maternal exhaustionand deleyed second stage of labour. The commonest maternal complications were vaginal lacerations and perineal tears.

In this study the rate of vacuum extractions was reported to be 4.57% with preponderance in multiparous women. This rate is higher than that reported in several other studies. Thus, in a study in selected sub-Saharan African countries, the rates

varied between less than 0.1% in Congo Brazzaville and 1.0% in Niger (Bailey et al. 2017). In India and Nigeria the rates as low as 0.73% (Bangal et al. 2012) and 0.9% (Yakasai et al. 2015) respectively have also been reported. In a three-year retrospective study at Muhimbili National Hospital, the reported rate was 0.93% (Mihungo, 2016).This low rate of use of vacuum assisted deliveries in sub-Saharan Africa and other developing countries has been attributed to lack of trained human resources, equipment and training (Nolens et al., 2016; Bailey et al., 2017) and also providers' beliefs that vacuum extraction can cause trauma to the baby and fear of HIV transmission (Nolens et al. 2016; Ameh& Weeks, 2009). However, the high rate of vacuum-assisted deliveries at Temeke Regional Referral Hospital could have been the result of the intervention initiated by CCBRT of training middle-cadre health professionals to carry out vacuum extractions and also provision of equipment for the purpose. This is consistent to the results observed in a similar intervention that was conducted at Mulago Teaching Hospital in Uganda whereby a 300-fold increase in the rate of vacuum-assisted deliveries (from 0.6% to 2.4%) within a spell of 18 months was observed (Nolens et al., 2016).

The most common indications of vacuum-assisted delivery in our study were maternal exhaustion, delayed second stage of labour and fetal distress, in that order. A study by Hafeez et al. (2013) in Pakistan reported fetal distress, prolonged second stage of labour and poor maternal effort (in that order) as the common indications for application of the vacuum extractor. Another study in Nepal reported fetal distress as the common indication of delivery by vacuum extractor followed by delayed second stage of labour and poor maternal effort (Giri&Vaidya, 2008).Other studies in Nigeria the commonest indication of vacuum delivery was prolonged second stage of labour (Yakasai et al. 2015; Mutihir& Pam 2007; Abdulkarim et al. 2005).The variation in the common indication of vacuum deliveries between countries and within the country could be explained by the fact that, as opposed to our study in which there was preponderance of multipara women who underwent vacuum-assisted delivery, in other studies there was predominance of primiparas who are characterized by inexperience in labour, unnecessary anxiety and tightness of lower genital tracts.

Lower rates of maternal and neonatal complications have been reported to be associated with vacuum-assisted deliveries in many studies worldwide.ref However, maternal complications after vacuum-assisted deliveries in this study occurred in two-thirds (66.7%) of the women. This rate is very high compared to rates reported in other studies done elsewhere in both developed and low- and middle-income countries. For example, Giri and Vaidya (2008) and Shrestha et al. (2016) in Nepal reported an overall maternal morbidity rates of 20% and 17.3% respectively. Also, a 5-year retrospective study at UsmanuDandfodiyo University Teaching Hospital in Sokoto, Nigeria found an overall maternal complication rate for instrumental deliveries (both forceps and vacuum extraction) to be 18.4% (Shehu&Omembelede, 2016). Another 3-year retrospective study at Muhimbili National Hospital in Dar es Salaam, Tanzania reported an overall incidence rate of 0.93% (Mihungo, 2016). The possible explanation for such a high rate of maternal complications after vacuum-assisted delivery could possibly be attributed to the fact that the professionals carrying out the extraction were novices and majority of them (95%) were middle cadres (registered nurses/midwives and registrars) who may lack confidence, have a deficiency in skills and the experience in performing vacuum assisted vaginal delivery as evidenced by the resultant common types of maternal complications (vaginal lacerations and perineal tears).

Regarding the common maternal complications after vacuum-assisted delivery, vaginal lacerations accounted for about 65% followed by perineal tear (60%). Postpartum haemorrhage (PPH) was the least affecting 13% of women. Episiotomy was experienced by about 55% of the women. Other studies have reported PPH to be the common maternal complication following vacuum-assisted delivery (Mihungo, 2016; Yakasai et al. 2015; Islam et al. 2008; Yarrow et al. 2004) those the rates were lower than 20%. However, consistent with our study finding, a study in New York also found that vaginal lacerations and perineal tears were the common maternal complications following vacuum-assisted delivery (Johnson et al. 2004). They implicated the accidental inclusion of these tissues into the cup as the main cause. Also, they assert that longer second stage of labour increases the risk for vaginal lacerations and perineal tears.

In our study no complications were observed in neonates. As commonly reported neonatal complications such as low Apgar score (Yusuf & Facha, 2016; Mihungo 2016; Giri & Vaidya 2008). Other neonatal complicatiions reported in other studies such as cephalohematoma (Giri & Vaidya 2008) and perinatal asphyxia (Yusuf & Facha, 2016) were not observed in our study.

Our study shows that vaccuum-assisted vaginal delivery, which was not accompanied by any severe maternal and neonatal complication, can benefit pregnant women and reduce maternal and neonatal deaths if proper training, equipment and facilities are available.

CONCLUSION

The use of Vacuum Assisted vaginal delivery was reported to be 4.57% with preponderance in multiparous women. The common indications of Vacuum Assisted vaginal delivery were maternal exhaustion and delayed second stage of labour. The procedure when used correctly could lead to reduction of maternal and neonatal morbidity and mortality by reducing second stage caesarian sections. However, the high rate of vacuum-assisted deliveries at Temeke Regional Referral Hospital could have been the result of the intervention

initiated by CCBRT of training middle-cadre health professionals to carry out vacuum extractions and also provision of facilities for the purpose.

RECOMMENDATIONS

- The rate of vacuum-assisted deliveries incrased due to concerted efforts of CCBRT at TRRH to train middle cadres and provision of the required equipment and facilities for the purpose. It is therefore recommended that a dedicated training course be introduced at all middle-level (clinical officers, nurse/midwives) and higher learning medical schools be incorporated in the curriculum.
- Vacuum-assisted vaginal delivery was found to be successful because no severe maternal and neonatal complications were observed including maternal and neonatal deaths. Thus, it is recommended that the intensification in the use of Vacuum Assisted vaginal delivery in health facilities be encouraged through the provision of the required training and provision of equipment and wherever possible apply task-shifting where the required health personnel to carry out VAD are absent. This will lead to reduction of maternal and neonatal morbidity and mortality which currently still stands above the recommended threshold in Tanzania..
- More studies should be performed on AVD to evaluate fetal and maternal outcome in different health facilities in our count

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