

Outcomes of Operative Vaginal Delivery and Associated Factors at Aksum Saint Mary Hospital, Tigray, Northern Ethiopia

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Abstract

Background: Obstetrical intervention is an option to accomplish safe delivery for a mother, if she is in need of it and technically feasible. Approximately 10-20% of all deliveries require some form of obstetrical interventions. In the current study setting, operative vaginal delivery is a frequently practiced procedure, but little is known about its outcome. Therefore, this study was aimed to assess the outcomes of operative vaginal delivery and its associated factors at Aksum Saint Mary hospital, Tigray, Northern Ethiopia.

Methods: A facility-based cross-sectional study was conducted on 326 charts of mothers, selected by a systematic random sampling technique, who gave birth by operative vaginal delivery from September 1, 2013 to August 31, 2018. Data were collected using a pretested checklist and analyzed by using Statistical Package for Social Sciences software Version 20. Logistic regression analysis was conducted to identify factors associated with the maternal outcomes. A statistical significance was declared at $p < 0.05$.

Results: About 19% (95% CI: 14.7, 23.0) of the operative vaginal deliveries had unfavorable outcomes. The common type of maternal complication was post-partum hemorrhage (33.9%). Forceps delivery (AOR=2.24; 95% CI: 1.14, 4.41), fetal head above the ischial spine when operative vaginal delivery was applied (AOR=3.19; 95% CI: 1.35, 7.53), neonatal birth weight greater than or equal to 4000 grams (AOR=3.34; 95% CI: 1.43, 7.78), and second stage labour greater than or equal to 3 hours duration (AOR=2.55; 95% CI: 1.03, 6.28) were factors associated with the unfavorable outcomes of operative vaginal delivery.

Conclusion: Almost one in five of the operative vaginal deliveries assessed in this study had unfavorable outcome. Therefore, health professionals particularly midwives working at maternity unit of the hospital are expected to perform deliberate assessment of operative vaginal delivery needs in advance of care by considering the identified factors.

Keywords: *Associated factors; Forceps delivery; Maternal outcome; Operative vaginal delivery; Vacuum delivery*

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Introduction

Labor and delivery is complex physiologic process which involves two human beings: the mother and the baby. Operative vaginal delivery, which can be instrumental vaginal delivery (forceps and vacuum extraction), accounts for 2-23% of all the deliveries worldwide (Bird, 2008). Instrumental vaginal delivery can result in maternal obstetric trauma that happens in 160.5 deliveries per 1,000 instrument assisted vaginal births (Lacker, 2012).

Complications are serious and more common with vacuum than forceps delivery (Alegbeleye *et al.*, 2018). Complications from vacuum assisted delivery (VAD) arise in the form of cervical tear; vaginal tear; hemorrhage; third and fourth-degree perinatal tears;

and anal sphincter injury. This may predispose the women for a great health risks and bad socioeconomic consequences, divorce and economic dependency, in her future life (Kraft, 2015; Shamsa *et al.*, 2013). Forceps deliveries also have an impact on parturient as well to the family and the community (Dietz *et al.*, 2016; Philippe, 2016). The study has shown that the risk of encountering maternal complications is 4.8 times more common with forceps than with ventous (vacuum) extraction (Shekhar, 2015; Patel, 2018; Alegbeleye *et al.*, 2018). A study conducted in Liverpool Hospital, Australia, revealed that, the risk of 3rd and 4th degree perineal injury was higher for forceps types of OVDs than vacuum types of OVD (Shamsa *et al.*, 2013).



The magnitude of operative vaginal delivery complications/unfavorable outcomes have been reported differently from different studies. It was reported 11.8% to 15% from Nigeria, and 4.1% to 45.1% from Ethiopia. The most common complications observed are perineal tear, post-partum hemorrhage (PPH), cervical tear, perianal injury, and death (Adaji *et al.*, 2009; Alegbeleye *et al.*, 2018; Gebre and Hailu, 2017; Hubena *et al.*, 2018). A study conducted in the University of North Carolina, United States of America, shows that operative vaginal delivery was associated with a 4-fold increased risk of anal sphincter injury (Shekhar, 2015).

Different factors have been identified to be associated with unfavorable maternal outcome of operative vaginal deliveries. Some of them were occiput-posterior position, health professional types/skill and types of operative vaginal delivery (vacuum vs forceps) (Shekhar, 2015; Patel, 2018; Alegbeleye *et al.*, 2018).

Outcomes of operative vaginal deliveries and its associated factors have been reported differently from different parts of the world (Adaji *et al.*, 2009; Alegbeleye *et al.*, 2018; Gebre and Hailu, 2017; Shekhar, 2015), but, there is no recorded document about it in the current study area. Assessing the maternal outcome of operative vaginal delivery and its associated factors would be useful in adopting suitable measures to reduce maternal morbidity and mortality. Therefore, this study was aimed to assess the maternal outcomes of operative vaginal deliveries and its associated factors at Aksum Saint Mary hospital, Tigray, Northern Ethiopia.

Materials and Methods

Study Setting

This study was conducted at a St. Mary general hospital in Aksum town. The town is located 1033 km North East of Addis Ababa, the capital city of Ethiopia, and 250km to the North-West from Mekelle, the capital city of the Tigray Regional State. The hospital was established in 1952. It has 320 clinical and administrative staffs. Currently it gives different health services: antenatal care, labor and delivery, postnatal care, neonatal intensive care, and surgery. In addition, it provides in and out-patient services for medical, surgical, gynecology, as well as pediatric patients. The department of obstetrics and gynecology has two

inpatient (gynecology and obstetrics), one maternal health clinic, one gynecologic Outpatient Department (OPD), and one family planning clinic. It has one obstetrician and gynecologist, one emergency surgery surgeon and 16 Midwives. The labor ward has 5 beds and 3 delivery couches. Maternity ward has 25 beds, 2 emergency operation rooms, and one recovery room with 2 beds and 2 resuscitation tables for newborns. The hospital is also serving as a training center. Currently, it is giving services to around 1.5 million people. There were a total of 2889 average deliveries recorded per year using annual report of the hospital (HMIS Aksum St. Mary Hospital, 2018).

Study design, population and period

A facility-based cross-sectional study was conducted at Aksum St. Mary Hospital from October to November 2018 by retrospectively reviewing maternal cards who got OVD services from September 1, 2013 to August 31, 2018.

Sample size and sampling procedures

Sample size was calculated by using a single population proportion formula by taking the proportion of maternal complications of operative deliveries in Hawassa (30.6%) (Bago, 2018), 5% margin of error and 95% confidence interval. The minimum sample size was 326. List of 888 registration cards of mothers who had OVD from September 1, 2013 to August 31, 2018 were used as sampling frame to select maternal charts to be reviewed. The first chart was selected by lottery method. Then, the next study participants card were selected by systematic random sampling technique ($K=2$).

Inclusion and exclusion criteria

All mothers who gave at least one live birth by OVD (vacuum and forceps) were included in the study. Incomplete cards were excluded.

Data collection methods

Data were collected by three midwives holding a bachelor degree, using a checklist developed through literature review (Hubena *et al.*, 2018; Gebre and Hailu, 2017; Shekhar, 2015) and from the variables contained in the pregnant mothers' card. The checklist comprise of socio-demographic variables, obstetrical characteristics (parity, gravidity), type of instrument applied for

delivery (Vacuum or forceps), obstetrics complications following instrumental delivery (vaginal/cervical tear, postpartum hemorrhage (PPH)), and indications for operative vaginal delivery (Heart disease, maternal exhaustion).

Quality control

Before the actual data collection, the checklist was pre-tested on 5% of the sample size on eligible maternal cards at Ayder referral hospital, Tigray, Ethiopia. Then, corrections and amendments were made. Training was given for the data collectors for 3 days. During data collection, the checklist was checked for completeness on daily basis by supervisors and the principal investigator.

Definitions of terms

Operative vaginal delivery: a delivery in which the operator uses forceps or a vacuum device to assist the mother in transitioning the fetus to extra uterine life during second stage of labor (Royal College of Obstetricians and Gynaecologists, 2011).

Favorable Outcome: delivered pregnant mother without complication after operative vaginal delivery (Siraneh *et al.*, 2018).

Unfavorable Outcome: when mother developed at least one adverse maternal complication like PPH, genital tear (like first degree, second degree, third degree or fourth degree vaginal tear due to episiotomy extension), periurethral/labial tear, cervical tear, need of blood transfusion, need of major surgery and death after operative vaginal delivery (Siraneh *et al.*, 2018).

Malposition: The fetal position other than occiput-anterior position (Houghton, 2018)

Data analysis

The collected data were cleaned, entered in to EpiData 4.2, and exported to SPSS Version 20 for windows for analysis. Descriptive statistics were used to describe the main features of the data. Multivariable logistic regression analyses was performed to identify associated factors with unfavorable maternal outcome with operative vaginal delivery. Variables with $p < 0.2$ in the bivariable analysis were candidate for multivariable

analysis. Finally, in the multivariable analysis, statistically significant factors were declared at $p < 0.05$, with 95% confidence interval (CI).

Ethical Considerations

Ethical clearance was obtained from Institutional Research Review Board of College of Health Sciences of Mekelle University with Ref No. RPDO/MU-NMBU/MSC/120/2018. Official letter of cooperation was obtained from Tigray Regional Health Bureau and submitted to Aksum St. Marry hospital. Information was collected anonymously and confidentiality was assured throughout the study period.

Results

Socio-demographic characteristics

In this study, 326 medical records of mothers who gave birth by operative vaginal delivery were assessed. The mean age of the mothers was 26.1 (SD±6.069). The minimum and maximum age of the mothers were 15 and 41, respectively. One hundred forty seven (45.1%) of mothers were between 20-24 years of age and house wife by their occupation. Majority of the mothers were married 272 (83.4), urban resident 262 (80.4%), and orthodox Christian 259 (79.4%) (Table 1).

Indications of operative vaginal delivery

The operative vaginal delivery was performed due to many demanding indications. Among this, fetal distress 93 (28.5%), malposition other than occipito-anterior position 92 (28.2%) and secondary to prolonged 2nd stage of labor 60 (18.4%) were the leading ones (Table 2).

Unfavorable Maternal outcome of OVD

A total of 62 (19%) (95% CI: 14.7, 23.0) mothers with operative vaginal delivery were encountered unfavorable outcomes. Out of those with unfavorable outcomes, 21 (33.9%), 11 (17.7%) and 9 (14.5%) of them developed PPH, cervical tears, and 1st degree vaginal tear, respectively. Need for blood transfusion, major surgery and death was not reported on the maternal card retrieved (Figure 1).

Table1: Socio-demographic characteristics of mothers who gave birth by operative vaginal delivery at Aksum St. Mary Hospital, Tigray, Northern Ethiopia, 2018 (n=326).

Variable	Category	Frequency	Percent (%)
Age (in years)	15-19	41	12.6
	20-24	108	33.1
	25-29	98	30.1
	30-34	35	10.7
	35-39	29	8.9
	>40	15	4.6
Marital status	Married	272	83.4
	Widowed	15	4.6
	Divorced	5	1.6
	Unmarried	34	10.4
Residence	Urban	262	80.4
	Rural	64	19.6
Occupation	House wife	147	45.1
	Farmer	101	31.0
	civil servant	51	15.6
	Merchant	26	8.0
	Other*	1	0.3
Religion	Muslim	59	18.1
	Orthodox	259	79.4
	Protestant	7	2.1
	Catholic	1	0.3

*other: self-employed

Table 2: Indications for operative vaginal delivery among mothers who gave birth by Operative vaginal delivery at Axum St. Mary Hospital, Northern Ethiopia, 2018.

Variables		Frequency	Percent (%)
Prolonged 2 nd stage of labor	Yes	60	18.4
	No	266	81.6
Severe pre-eclampsia and/or eclampsia	Yes	16	4.9
	No	310	95.1
Heart disease	Yes	9	2.8
	No	317	97.2
Maternal exhaustion	Yes	45	13.8
	No	281	86.2
Severe anemia	Yes	10	3.1
	No	316	96.9
Fetal distress	Yes	93	28.5
	No	233	71.5
Malposition	Yes	92	28.2
	No	234	71.8
Cardiac diseases	Yes	1	0.3
	No	325	99.7

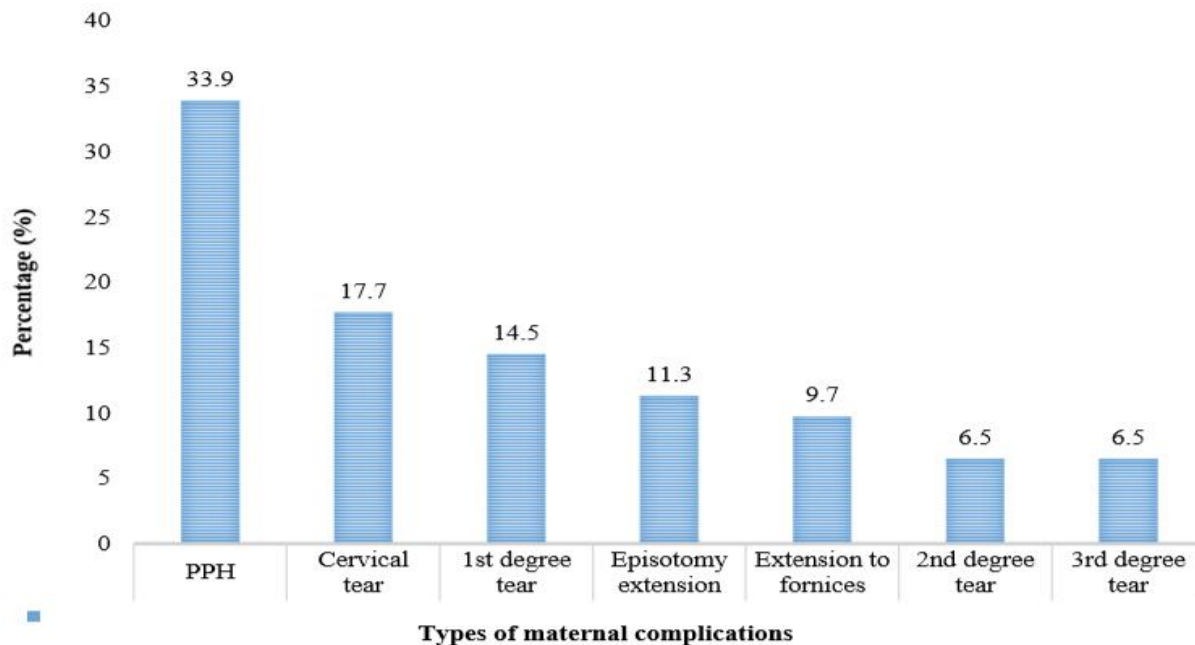


Figure 1: Types of maternal complications following OVD at Aksum St. Marry Hospital, Tigray, Northern Ethiopia, from October to November 2018.

Maternal outcome with obstetric characteristics

A total of 183 (56.2%) mothers has delivered for the first time. Twenty nine (21.5%) mothers who are Para II-IV encountered different degrees of unfavorable maternal outcomes. Two hundred fifty eight (79.1%) of mother were delivered at 37-42 weeks of gestation, while the highest unfavorable outcome 8 (23.5%) was found in gestational age of < 37 weeks. Two hundred ninety six (90.8%) mothers had Antenatal care (ANC) follow up, and of these, 186 (57.1%) attended four times or more. There is higher 24 (21.8%) unfavorable outcome on those mother with 1-3 ANC visits. A total of 154 (42.5%) mother with occiput-anterior position of fetal head; while the highest unfavorable outcome was found in occiput-posterior position of fetal head 29 (31.5%). Episiotomy was done for 201 (61.7%) mothers to facilitate procedures, from which 30 (14.9%) developed unfavorable outcomes. Majority of mother 228 (69.9%) were in the second stage of labor took less than 2 hours. However, those mothers with second stage of labor with greater than equal to 3 hours have more unfavorable outcome 12 (31.6%). Majority of the mother delivered a child with 2500-3999 grams

208 (57.5%); while 29 (35.4%) of unfavorable outcome was reported in those newborn having greater than equal to 4000 grams. Around three fifth 224 (61.8%) of OVD were performed by vacuum. The higher unfavorable outcome was found in forceps 29 (28.4%) types of OVD (Table 3).

Factors associated with unfavorable maternal outcome

Residence, position of fetal head, episiotomy for instrument application, station during OVD application, duration of 2nd stage of labor, types of operative vaginal delivery used, neonatal weight, prolonged second stage, fetal distress, and malposition were candidates for multivariable analysis.

In final multivariable analysis, factors like neonatal weight, types of OVD used, station during OVD application and duration of second stage were significantly associated with unfavorable maternal outcomes. Those mothers who delivered neonates weighing 4000 grams and above were 3.3 times (AOR=3.34; 95% CI: 1.43, 7.78) more likely to develop unfavorable mater-

nal outcomes related OVD compared to those who delivered neonates weighing 2500-3999 grams. Using forceps to assist vaginal delivery was 2.2 times (AOR=2.24; 95% CI: 1.14, 4.41) more likely to increase burden of unfavorable maternal outcomes than vacuum OVD. Application of instruments at high station was 3.1 times (AOR=3.19; 95% CI: 1.35, 7.53)

more likely to result unfavorable maternal outcomes related to OVD compared to outlet application. Those mothers who had ≥ 3 hours duration of second stage labor were 2.5 times (AOR=2.55; 95% CI: 1.03, 6.28) more likely to have unfavorable maternal outcomes than those who had 1-2 hours duration of second stage assisted with OVD (Table 4).

Table 3: Obstetric characteristics and maternal outcomes among mothers who gave birth by operative vaginal delivery in St. Mary Hospital, Northern Ethiopia, 2018.

Variables	Maternal Outcomes				
	Favorable Outcomes n (%)	Unfavorable Outcomes n (%)	COR (95% CI)	P-value	
Parity	1	151 (82.5%)	32 (17.5%)	1	
	2-4	106 (78.5%)	29 (21.5%)	1.50 (0.17,12.48)	0.717
	≥ 5	7 (87.5%)	1 (12.5%)	1.91 (0.22,16.19)	1.915
Gestational age (weeks)	37-42	210 (81.4%)	48 (18.6%)	1	
	<37	26 (76.5%)	8 (23.5%)	1.34 (0.57,3.15)	0.494
	>42	28 (82.4%)	6 (17.6%)	0.93 (0.36,2.39)	0.892
Gestational age evidenced by	LNMP	186 (83.8%)	36 (16.2%)	1	
	Ultrasound	29 (78.4%)	8 (21.6%)	1.42 (0.60,3.36)	0.419
	Fundal height	49 (74.2%)	17 (25.8%)	1.79 (0.92,3.45)	0.082
Number of ANC follow up visits	No ANC visit	26 (86.7%)	4 (13.3%)	0.68 (0.22,2.1)	0.511
	1-3	86 (78.2%)	24 (21.8%)	1.24 (0.69,2.24)	0.456
	4 or more	152 (81.7%)	34 (18.3%)	1	
Health institution where ANC attended	SMHA	109 (83.2%)	22 (16.8%)	1	
	Axum referral hospital	51 (76.1%)	16 (23.9%)	1.55 (0.75, 3.21)	0.265
	Health center	68 (80.0%)	17 (20.0%)	1.23 (0.61, 2.49)	0.565
	Private medium clinic	10 (83.3%)	2 (16.7%)	0.99 (0.37, 5.84)	0.832
Position of fetal head	Occiput anterior	132 (85.7%)	22 (14.3%)	1	
	Occiput posterior	63 (68.5%)	29 (31.5%)	2.76 (1.47, 5.18)	0.002
	Unknown	69 (86.2%)	11 (13.8%)	0.95 (0.43, 2.08)	0.911
Episiotomy done	Yes	171 (85.1%)	30 (14.9%)	0.51 (0.29, 0.89)	0.018
	No	93 (74.4%)	32 (25.6%)	1	
Station during OVD application	Above the ischial spine	178 (76.7%)	54 (23.3%)	3.26 (1.48,7.15)	0.003
	Below the ischial spine	86 (91.5%)	8 (8.5%)	1	
Duration of 2 nd stage of labor (hour/s)	<2	192 (84.2%)	36 (15.8%)	1	
	2-3	46 (76.7%)	14 (23.3%)	1.62 (0.80, 3.25)	0.173
	>3	26 (68.4%)	12 (31.6%)	2.46 (1.13, 5.32)	0.022
Weight of the new born in gram	1500-2499	23 (88.5%)	3 (11.5%)	0.81 (0.23, 2.89)	0.754
	2500-3999	188 (86.2%)	30 (13.8%)	1	
	≥ 4000	53 (64.6%)	29 (35.4%)	3.42 (1.89, 6.21)	0.000
Types of OVD used	Vacuum	191 (85.3%)	33 (14.7%)	1	
	Forceps	73 (71.6%)	29 (28.4%)	2.29 (1.30, 4.05)	0.004
Previous place of delivery in health institution	Yes	97 (78.2%)	27 (21.8%)	1	
	No	167 (82.7%)	35 (17.3%)	0.75 (0.43,1.31)	0.321
Previous mode of delivery	Spontaneous vaginal delivery	59 (80.8%)	14 (19.2%)	1	
	Operative vaginal Delivery	29 (74.4%)	10 (25.6%)	1.45 (0.57,3.66)	0.429
	Cesarean section	9 (75.0%)	3 (25.0%)	1.40 (0.33,5.87)	0.641

ANC: Antenatal Care, LNMP=Last Normal Menstrual Period, SMHA: Saint Mary Hospital Aksum

Table 4: Factors associated with maternal outcomes among mothers who gave birth by OVD at Aksum St. Marry Hospital, Tigray, Northern Ethiopia, 2018.

Variables		Maternal Outcomes		COR (95% CI)	AOR (95% CI)
		Unfavorable n (%)	Favorable n (%)		
Residence	Urban	40 (15.3%)	222 (84.7%)	1	1
	Rural	22 (34.4%)	42 (65.6%)	2.90 (1.57, 5.38)	1.17 (0.50, 2.75)
Position of fetal head	Occiput anterior	22 (14.3%)	132 (85.7%)	1	1
	Occiput posterior	29 (31.5%)	63 (68.5%)	2.76 (1.47, 5.18)	1.82 (0.46, 7.16)
	Unknown	11 (13.8%)	69 (86.2%)	0.95 (0.43, 2.08)	1.50 (0.60, 3.75)
Episiotomy for instrumentation	Yes	30 (14.9%)	171 (85.1%)	0.51 (0.29, 0.89)	0.62 (0.32, 1.18)
	No	32 (25.6%)	93 (74.4%)	1	1
Station during OVD used	Above the ischial spine	54 (23.3%)	178 (76.7%)	3.26 (1.48, 7.15)	3.19 (1.35, 7.53)*
	Below the ischial spine	8 (8.5%)	86 (91.5%)	1	1
Duration of 2 nd stage of labor	<2	36 (15.8%)	192 (84.2%)	1	1
	2-3	14 (23.3%)	46 (76.7%)	1.62 (0.80, 3.25)	1.66 (0.71, 3.86)
	>3	12 (31.6%)	26 (68.4%)	2.46 (1.13, 5.32)	2.55 (1.03, 6.28)*
neonatal weight (in gm)	2500-3999	30 (13.8%)	188 (86.2%)	1	1
	1500-2499	3 (11.5%)	23 (88.5%)	0.81 (0.23, 2.89)	0.54 (0.12, 2.42)
	≥4000	29 (35.4%)	53 (64.6%)	3.42 (1.89, 6.21)	3.34 (1.43, 7.78)*
Type of OVD used	Vacuum	33 (14.7%)	191 (85.3%)	1	1
	Forceps	29 (28.4%)	73 (71.6%)	2.29 (1.30, 4.05)	2.24 (1.14, 4.41)*
Prolonged 2 nd stage of labor	Yes	19 (30.2%)	44 (69.8%)	2.20 (1.17, 4.14)	0.90 (0.39, 2.03)
	No	43 (16.3%)	220 (83.7%)	1	1
Fetal distress	Yes	24 (13.1%)	159 (86.9%)	0.41 (0.23, 0.73)	0.60 (0.30, 1.21)
	No	38 (26.6%)	105 (73.4%)	1	1
Malposition	Yes	28 (31.5%)	61 (68.5%)	2.74 (1.54, 4.87)	1.55 (0.39, 6.20)
	No	34 (14.3%)	203 (85.7%)	1	1

* $p < 0.05$

Discussion

In this study, the overall magnitude with unfavorable maternal outcome was unacceptably high which 19% is (95% CI: 14.7, 23.0). Forceps type of operative vaginal delivery, high station where operative vaginal delivery was applied, neonatal birth weight greater than or equal to 4000 grams, and duration of second stage greater than or equal to 3 hours were factors identified as significantly associated with the unfavorable maternal outcomes of operative vaginal delivery.

This finding of the overall magnitude of unfavorable maternal outcome is similar to the study findings reported from University of Port Harcourt Teaching Hospital, Nigeria (15.85%) (Alegbeleye *et al.*, 2018) and Lumbini Medical College Teaching Hospital, Nepal (17.3%) (Shrestha and Shrestha, 2016). The current study finding is higher than the findings reported

from studies conducted at Jimma Medical Center (4.1%) (Hubena *et al.*, 2018), Ahmadu Bello University Teaching Hospital Zaria, Nigeria (11.8%) (Adaji *et al.*, 2009), and Mahatma Gandhi Medical College, India (12.5%) (John and Nischintha, 2014). But, it was lower than reported from Suhul General Hospital, Ethiopia (45.4%) (Gebre and Hailu, 2017). The difference might be due to study setting, type of the health professionals attended the procedure the skill of the health professionals attended OVD or maternal indications for OVD.

The commonest maternal complication in this study was postpartum hemorrhage (33.9%). This is higher than the findings reported from studies conducted at Jimma Medical Center (3.3%) (Hubena *et al.*, 2018), Tertiary Hospital, Mumbai, India (4.01%) (Faisal *et al.*, 2016), Lumbini Teaching Hospital, Nepal (3.8%) (Shrestha, and Shrestha, 2016) and Amino Kano Hospital, Nigeria (9.5%) (Yakasai *et al.*, 2015). But it is

lower compared to the finding from Port Harcourt Teaching Hospital in Nigeria (42.3%) (Alegbeleye *et al.*, 2018). This difference might be due difference in maternal presentation to health facility; risk factors of PPH; in their diagnosis and management, postpartum management practices and blood loss documentation practice of the health facility.

Those mother having neonates with birth weight ≥ 4000 gm were more likely to develop one of the unfavorable outcomes. This result is consistent with other two independent studies in Jimma (Aiken *et al.*, 2014; Hubena *et al.*, 2018). The possible explanation for the similarity could be due to the fact that the women who had neonatal weight >4000 gm and prolonged labor are at risk of developing PPH as a result of uterine atone and perineal lacerations (Nyfløt *et al.*, 2017). High station during OVD application is significantly associated with unfavorable maternal outcome. This might be due to the descent problem that indicated no progress of labor secondary to cephalopelvic disproportion (CPD), it may be due to macrosomic baby, and can cause PPH secondary to perineal tear (Maharaj, 2010). This finding is consistent with a study conducted in Suhul shire, Ethiopia, instrument application in high station (station above 2), COR=7.4 (95% CI: 3.28-16.6), is significantly associated with unfavorable maternal outcomes (Gebre and Hailu, 2017).

In the present study, forceps type of delivery were significantly associated with unfavorable maternal outcome. Similar results have been reported from Hawassa University Teaching and Referral Hospital in Ethiopia, Liverpool Hospital, in Australia, Shankar Nagarin in India, and Jinnah Hospital in Lahore (Shekhar *et al.*, 2013; Shamsa *et al.*, 2013; Abha and Pratibha, 2014; Bago, 2018). But it is different when compared with findings from a study of Port Harcourt University Teaching Hospital, Nigeria, in which vacuum type of instrument was significantly associated with unfavorable maternal outcome (Alegbeleye *et al.*, 2018). Studied conducted from Jimma Medical Center and Suhul Shire Hospital also indicated no difference of unfavorable maternal outcome in between Vacuum or Forceps delivery (Gebre and Hailu, 2017; Hubena *et al.*, 2018). This variation could be due to the different skill of operators and choice of instrument with properly selected cases.

In this study, ≥ 3 hrs duration of second stage of labor assisted with OVD had a significant association with the unfavorable maternal outcome. This is different from a study conducted in Stockholm, Sweden, showed that the mothers in 2nd stage labor for 1-2 hours were in a higher risk of unfavorable maternal outcome than those with three hours or more duration (Simic *et al.*, 2017). This variation could be due to the difference in study area, variation in decision to perform OVD, pregnancy or other maternal factors.

This study used the medical cards of the pregnant mother, which included the physical findings aid to capture a more holistic, complete and complementary picture of the problem under study. However, some important variables were identified as missed. Our study findings may not be also generalized to all health facilities in Aksum, since the study was conducted at one health institution.

Conclusion

The magnitude of unfavorable maternal outcome among the mothers who gave birth by OVD is high. Low fetal head station during delivery, duration of second stage lasts >3 hrs, mothers having a neonatal birth weight of >4000 grams and forceps types of delivery were associated with unfavorable maternal outcome. Therefore, health professionals working in the maternity unit in the hospital are expected to perform deliberate assessment of OVD needs in advance of care. The hospital should give practical training on safe operative vaginal delivery by considering identified factors. In addition, further prospective study, by including different factors using large sample size and area, is recommended.

Competing Interests

We declare that we have no competing interests

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Authors' contributions

TW designed, conceived, analyzed the data and prepared the first draft of the manuscript. ML and AM involved in data analysis, drafting of the manuscript and advising the corresponding author during the entire process as well as involved in critically reviewing the design, literature, interpretation of the analysis and report writing, and provides constructive comments and guidance for the corresponding author.

References

- Abha, S. and Pratibha, R. 2014. Feto-Maternal Outcome in Instrumental Vaginal Delivery. *Journal of Obstetrics and Gynecology of India*, 61 (6): 663-666. DOI: 10.1007/s13224-011-0119-3.
- Adaji, S. E., Shittu, S. O. and Sule, S. T. 2009. Operative vaginal deliveries in Zaria, Nigeria. *Annals of African Medicine*, 8 (2):95-99. DOI: 10.4103/1596-3519.56236.
- Aiken, C. E. Aiken, A.R., Brockelsby, J.C. and Scott, J.G. 2014. Factors Influencing the Likelihood of Instrumental Delivery Success. *Obstetrics & Gynecology*, 123 (4):796-803. DOI: 10.1097/AOG.000000000000188
- Alegbeleye, J.O., Orazulike, N.C., Nyengidiki, T.K., Uzoigwe, S.A. 2018. A 10-year review of instrumental vaginal delivery at the University of Port Harcourt Teaching Hospital, Port Harcourt, Nigeria. *Tropical Journal of Obstetrics and Gynecology*, 35 (2):118-122.
- Bago, B. J. 2018. Prevalence and Its Associated Factors among Women Undergone Operative Vaginal Delivery at Hawassa University Comprehensive Specialized Gynecology & Obstetrics. *Gynecology Obstetrics*, 8 (2): 2-7. DOI: 10.4172/2161-0932.1000461.
- Bird, G.C. 2008. Modification of malmstorms vacuum extractor, 13th Edition. New York, USA
- Dietz, H. P., Lanzarone, V. and Simpson, J. M. 2016. Predicting operative delivery. *Ultrasound Obstetrics Gynecology*, 27 (3): 409-415. DOI: 10.1002/uog.2731.
- Faisal, S., Bava, A. and Nandanwar, Y. S. 2016. Instrumental vaginal deliveries at tertiary centre. *International Journal of Reproduction, Contraception, Obstetrics and Gynecology*, 5 (12): 4146-4150. DOI: 10.18203/2320-1770.ijrcog20163997
- Gebre, S., Hailu, A. 2017. Complications of Instrumental Vaginal Deliveries and Associated Factors at shul General Hospital, Tigriay. *Obstetrics and Gynecology*, 5 (2): 12-14. DOI: 10.4172/2329-9126.1000300.
- Health Management Information System (HMIS). 2018 Aksum St. Mary Hospital, Northern Ethiopia
- Houghton, 2018. Malposition - Medical Definition. Houghton Mifflin Harcourt Publishing Company. www.yourdictionary.com/malposition (Accessed on January 2017).
- Hubena, Z., Workneh, A. and Siraneh, Y. 2018. Prevalence and Outcome of Operative Vaginal Jimma University Medical Center, Southwest Ethiopia. *Hindawi Journal of pregnancy*, 2018 (Article ID 7423475):12. DOI: <https://doi.org/10.1155/2018/7423475>
- John, L. B. and Nischintha, S. 2014. Outcome of Operative vaginal delivery in a teaching hospital: A 2 year experience. *Journal of natural science, Biology and Medicine* 5 (1): 155-157. DOI: 10.4103/0976-9668.127316.
- Kraft, K. 2015. Guide lines for preventing Maternal and Neonatal Harm during vacuum vaginal delivery. *Pennsylvania Patient Safety Authority*, 16 (6):7-17.
- Lacker, C., 2012. Preventing maternal and neonatal harm during vacuum-assisted vaginal delivery. *The American Journal of Nursing*, 112 (2): 65-69.
- Maharaj, D. 2010. Assessing Cephalopelvic Disproportion: Back to the Basics. *Obstetrical & gynecological survey*, 65 (6):387-95. DOI: 10.1097/OGX.0b013e3181ecd0c
- Nyfløt, L.T., Sandven, I., Stray-Pedersen, B., Pettersen, S., Al-Zirqi, I., Rosenberg, M. 2017. Risk factors for severe postpartum hemorrhage: a case-control study. *BMC Pregnancy and Child Birth*, 17 (2017):17. DOI 10.1186/s12884-016-1217-0
- Philippe, N. 2016. *Operative deliveries*. https://www.gfmer.ch/Medical_education_En/Cameroon/Pdf/Operative_deliveries.pdf
- Royal College of Obstetricians and Gynaecologists. 2011. Operative Vaginal Delivery. Green-top Guideline No. 26. London: RCOG Press.

- <https://www.rcog.org.uk/en/guidelines-research-services/guidelines/gtg26/> (Accessed on December, 2017)
- Shamsa, A., Bai, J., Raviraj, P., Gyaneshwar, R. 2013. Mode of delivery and its associated maternal and neonatal outcomes. *Open Journal of Obstetrics and Gynecology*, 3 (3): 307-312.
- Shekhar, S., Rana, N., Jaswal, R. S. 2013. A Prospective Randomized Study Comparing Maternal and Fetal Effects of Forceps Delivery and Vacuum Extraction. *Journal of obstetric and Gynaecology India*, 63 (2):116-9. DOI: 10.1007/s13224-012-0282-1.
- Shrestha, B. K. and Shrestha, S. 2016. Instrumental vaginal delivery in short term maternal and neonatal outcome in a tertiary hospital of Nepal. *Journal of Lumbini Medical College*, 4 (2): 104-107. DOI: 10.22502/jlmc.v4i2.101.
- Siraneh, Y., Workneh, A. and Hubena, Z. 2018. Factors Affecting Feto-Maternal Outcome of Operative Vaginal Delivery among Mothers Who Gave Birth at Jimma University Medical Center. *Advances in Obstetrics and Gynaecology*, AOAG-102 (2018) 1-12.
- Simic, M., Cnattingius, S., Petersson, G., Sandström, A. and Stephansson, O. 2017. Duration of second stage of labor and instrumental delivery as risk factors for severe perineal lacerations : population-based study. *BMC Pregnancy and Childbirth*, 17 (2017):72. DOI 10.1186/s12884-017-1251-6
- Yakasai, A., Abubakar, S., Yunus, E.M. 2015. Vacuum Delivery in a tertiary institution, in Northern Nigeria: A 5-year review. *Open Journal of Obstetrics and Gynecology*, 5 (4): 213-8. DOI: 10.4236/ojog.2015.54031