Published in final edited form as:

BJOG. 2016 April ; 123(5): 831–836. doi:10.1111/1471-0528.13901.

Association between parity and fistula location in Malawian women with obstetric fistula: a multivariate regression analysis

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Partial results were presented at the following conferences: 6th Consortium of Universities for Global Health Annual Conference in Boston, MA (March 26–28, 2015)

Disclosure of Interests

The authors report that there are no conflicts of interest.

Author Contributions

JW, JT and MH conceptualized the study. JW, MM, MM and EC oversaw operational aspects of the study. DK and AS conducted the data analysis under the guidance of NR. AS drafted the manuscript. All authors revised the manuscript and approved the final draft.

Details of ethics approval

Ethical approval was given by the National Health Sciences Research Committee of Malawi (Protocol # 929, dated 9 April 2015) and the UNC School of Medicine IRB (Ref#: 11-2345, dated 4 May 2015)

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Abstract

Objective—To compare primiparous and multiparous women who develop obstetric fistula (OF) and to assess predictors of fistula location

Design—Cross-sectional study

Setting—Fistula Care Center at Bwaila Hospital, Lilongwe, Malawi

Population—Women with OF who presented between September 2011 and July 2014 with a complete obstetric history were eligible for the study.

Methods—Women with OF were surveyed for their obstetric history. Women were classified as multiparous if prior vaginal or cesarean delivery was reported. Location of fistula was determined at operation. OF involving the urethra, bladder neck, and midvagina were classified as low; OF involving the vaginal apex, cervix, uterus, and ureters were classified as high.

Main Outcome Measures—Demographic information was compared between primiparous and multiparous women using Chi-squared and Mann-Whitney U tests. Multivariate logistic regression models were implemented to assess the relationship between variables of interest and fistula location.

Results—During the study period, 533 women presented for repair, of which 452 (84.8%) were included in the analysis. The majority (56.6%) were multiparous when the fistula formed. Multiparous women were more likely to have labored less than a day (62.4% vs 44.5%, $p<0.001$), delivered a live-born infant (26.8% vs 17.9%, $p=0.026$), and have a high fistula location (37.5% vs 11.2%, $p<0.001$). Multiparity (aOR=4.55, 95% CI 2.27–9.12) and history of cesarean delivery (aOR=4.11, 95% CI 2.45–6.89) were associated with development of a high fistula.

Conclusions—Multiparity was common in our cohort, and these women were more likely to have a high fistula. Additional research is needed to understand the etiology of high fistula including potential iatrogenic causes.

Keywords

obstetric fistula; multiparity; iatrogenic injury; cesarean section

Introduction

Approximately 2 million women worldwide are affected by obstetric fistula (OF). In Malawi, the prevalence of OF is estimated to be 1.6 per 1000 women (1, 2), one of the highest estimates in the world. Previous descriptive studies in sub-Saharan Africa have found that a majority of fistula patients are young, primiparous women with short stature – all factors that contribute to an immature and contracted pelvis, cephalopelvic disproportion, and obstructed labor (3, 4). However, older and multiparous women also develop OF, even

though they are less likely to have risk factors for obstructed labor. These multiparous women may have different etiologies for OF than women who are primiparous at the time of fistula formation.

The location of the OF can aid in determining the mechanism of injury. Fistulas located in the upper urogenital tract (vaginal apex, cervix, uterus, or involving the ureters) are more likely to be associated with operative injury when compared to lower fistulas (urethra, bladder neck, or midvagina), which are associated with pressure necrosis from prolonged, obstructed labor (2, 5). Correct classification of the OF location and accurate obstetric history information, such as parity and type of delivery, are important to understand the possible mechanism of how and why a woman's fistula formed.

Therefore, our objectives were 1) to compare the baseline characteristics of Malawian women who are primiparous to those who are multiparous at the time of fistula formation and 2) to determine associations between delivery characteristics at the time of fistula formation, including parity, and OF location.

Methods

Study Setting

This study took place at the Freedom from Fistula Foundation Fistula Care Center at Bwaila Hospital in Lilongwe, Malawi. The Fistula Center receives referrals from all regions of Malawi as well as western Mozambique and eastern Zambia. Referred patients undergo a comprehensive history and physical examination. Patients determined to have a fistula are admitted and scheduled for surgical repair. A majority of surgeries were performed or overseen by the same surgeon.

Study Population

All women who presented to the Fistula Care Center between September 2011 and July 2014 were eligible for enrollment. Inclusion criteria were the present diagnosis of an OF and complete obstetric history. Women with residual incontinence after OF repair not attributed to residual fistula and those with non-obstetric causes of fistula were excluded.

Data collection

Staff trained in data collection recruited, consented, and enrolled eligible participants in either the local language (Chichewa) or English. Eligible women provided informed consent and completed a 30-minute baseline survey focusing on detailed demographic and obstetric history upon admission to the Fistula Care Center. Data from the patient's physical examination, surgical procedures, post-operative findings, and follow-up visits were also collected. Ethical approval was obtained from the National Health Sciences Research Committee of Malawi and the University of North Carolina School of Medicine Institutional Review Board. Women over 18 gave informed consent, while those under 18 underwent parental consent and pediatric assent. Trained research assistants double-entered and compared the data using REDCap (Research Electronic Data Capture, NC). The data were exported to Stata version 13.0 (StataCorp 2013, College Station, TX) for analysis.

Variables

Participant's demographic information and obstetric history were self-reported. For participants who did not know their birth date, age was assessed based on historic events or a clinician's estimation. HIV status was determined through testing of all participants during the admission when the survey was conducted. Parity was determined by the total of self-reported number of vaginal and cesarean deliveries which occurred prior to the formation of their fistula. For this analysis, patients were categorized as primiparous if they reported no prior vaginal or cesarean deliveries when the fistula formed or as multiparous if they had prior vaginal or cesarean deliveries. A fistula surgeon determined fistula location at the time of repair. Vesicovaginal fistulas (VVF) located in the vaginal apex, cervix, or uterus or involving the ureters were classified as high fistula, while those located in the urethra, bladder neck, or midvagina were classified as low fistula. Fistula location was analyzed only for women with current VVF.

Analytic Methods

Descriptive analysis was performed using means, medians, ranges, standard deviations and proportions. Chi-squared and Fisher's exact tests were used to test for associations between baseline characteristics and parity, and the Mann-Whitney U test was used to compare differences in medians for continuous variables that were not normally distributed. The α -level for all analyses was set at 0.05.

Unadjusted and adjusted odds ratios (OR) were calculated to estimate the association between covariates of interest and fistula location. The "exposed" group consisted of women who were multiparous when they developed a fistula. The "unexposed" group consisted of women who were primiparous when they developed a fistula. For multivariate modeling, potential confounding variables (multiparity, labor duration over 24 hours, peripartum operation, live-born infant) were assessed using directed acyclic graphs; backward elimination modeling was used to determine which possible confounders to include in the final adjusted models. Variables that led to 10% change in the primary coefficient of interest were kept in the model.

Results

Study Population

Between September 2011 and July 2014, a total of 533 women were admitted to the Fistula Care Center and recruited into the study, of which 472 (88.6%) had confirmed OF. A majority of the participants had a current VVF (n=452 women, 95.7%); nine of these women (2.0%) also had RVF in addition to VVF; and eight women (1.7%) had isolated RVF. Our analysis focused on the 452 women with VVF. Twelve women (2.5%) had no VVF location specified because they were previously repaired (n=6), underwent a urinary diversion (n=4), or the data was missing (n=2) (Figure 1).

The median age at presentation to the Fistula Care Center was 32 years (IQR 26–42 years) and the median age at the delivery causing the fistula was 22 years (IQR 19–30 years). At the time of the assessment, most of the participants reported living in a rural setting, working

as subsistence farmers, and achieving primary education or less (Table 1). Prior to presentation at the Fistula Care Center, 290 women (64.6%) already had a diagnosis of OF, and 107 (23.8%) had an operation but had a persistent fistula.

One hundred and ninety-six women (43.4%) were primiparous and 256 women (56.6%) were multiparous when their fistula formed. At the time of the delivery causing the fistula, 247 women (54.7%) had a cesarean delivery and 72 women (17.8%) had a hysterectomy. 54.7% of our cohort labored for less than 24 hours, and 22.9% delivered a live-born infant.

Descriptive Statistics

Comparing baseline characteristics of multiparous and primiparous women, there were no differences in residence, roof type, or education level (Table 1). Multiparous patients developed their fistulas at a later age (median 28 years [IQR 24–33.5 years] vs 19 years [IQR 17–20 years], $p<0.001$) and most commonly at their fourth delivery [IQR 3–6 deliveries].

Regarding the delivery which caused the fistula, multiparous women were more likely to have labored less than 24 hours (62.4% vs 44.5%, $p<0.001$), to have had a live-born infant (26.8% vs 17.9%, $p=0.026$), and to have had a hysterectomy at or around the time of delivery (26.3% vs 7.2%, $p<0.001$). At the time of the survey, multiparous patients were more likely to be currently married (69.3% vs 54.9%, $p=0.002$) and less likely to be underweight (7.3% vs 15.0%, $p=0.013$) when compared to women who were primiparous at the time of fistula formation.

Main Analyses

One hundred and eighteen women (26.2%) had a high fistula. A majority of these (81.4%) were multiparous patients. Table 2 compares characteristics of the patient and the delivery that predict a high fistula location. Unadjusted analyses showed an increase in the odds of a high fistula for multiparous women as compared to primiparous women (OR=5.73, 95% CI 3.27–10.03). After adjusting for age at delivery, multiparous women had a 4.55-fold increase in the odds of a high fistula (adjusted odds ratio [aOR]=4.55, 95% CI 2.27–9.12). History of a live-born infant (aOR=2.77, 95% CI 1.68–4.57) and a peripartum operation (either a cesarean delivery, hysterectomy at time of delivery or both) were also associated with the development of a high fistula (aOR=3.88, 95% CI 2.27–6.63). In women who did not have a peripartum operation, parity was also associated with an increased odds of high fistula (aOR=10.25, 95% CI 1.79–58.60).

Discussion

Main Findings

The majority of women at the Fistula Care Center in Lilongwe, Malawi were multiparous and reported a cesarean delivery at the time the OF formed. Women who were multiparous, had a peripartum surgery, and delivered a live-born infant were more likely to have a high fistula location. These findings suggest that urologic injury during cesarean section or hysterectomy may be contributing to the formation of fistulas in this population.

The typical fistula patient has been commonly described as a young, primiparous woman with prolonged labor before delivering a stillborn infant (5–7). However, consistent with our results, recent studies have recognized that patients with OF are more diverse. Similar to our findings, 59.2% of OF patients in Democratic Republic of Congo were multiparous (8), with a cesarean delivery rate as high as 63.8% in their obstetric fistula population (9). This may represent an evolving trend of greater overall access to emergency obstetric care, albeit care that often comes too late or by providers without adequate skill. One study from Niger found that 7% of patients had a live birth at the time of fistula formation (10), less than half the rate among our patient population.

Prolonged, obstructed labor often necessitates a cesarean delivery, even if the infant has already died in utero. This may lead to high rates of cesarean deliveries among obstetric fistula patients. Iatrogenic injury at the time of cesarean may also be responsible for obstetric fistula in low-resource settings (9, 11–13). A case control study from western Uganda found that cesarean deliveries increased a woman's odds of developing an obstetric fistula by more than 13-fold (11). Studies performed in Democratic Republic of Congo found that 38.4% of OF patients delivered by cesarean section, and 16.4% of their population had a presumed iatrogenic surgical etiology (9, 12), though definitive causality is difficult to prove. Unanticipated cesarean delivery performed late is a challenging surgery even for an experienced clinician.

Strengths and Limitations

The findings of this study are considered in light of some inherent limitations. Reliance on self-reporting of key variables (age, duration of labor, and parity) reduces accuracy. The medical and social characteristics measured reflect the status of the participants at time of presentation to the Fistula Center, not at the time of their fistula formation. Since we do not have medical records of the delivery causing the fistula, verification of labor duration, reason for cesarean delivery or hysterectomy, and documentation of clinicians' interventions for delivery and/or surgical complications could not be performed.

Despite these limitations, few studies provide specific documentation of the location of OF outside of Goh or Waaldjik classifications, the two more widely used OF classification systems, and both of these metrics focus on the closing mechanism (18). In this study, we were able to classify both fistula type and location within a large population of women with OF. Verification of a prior hysterectomy was also done at the time of operation with ultrasound or examination.

Interpretations

Prolonged, obstructed labor in low-resource settings may result in a higher incidence of ruptured uterus, postpartum hemorrhage, and necrotic and/or severely infected uterus necessitating hysterectomy. These complications are life-threatening and substantially increase the risk of urologic injury and subsequent fistula, in addition to the risks posed by the indications for the hysterectomy. In addition, cesarean delivery is a risk factor for future emergency peripartum hysterectomy (14); reported incidence rates of postpartum hysterectomy range from 0.2 to 5 per 1,000 women (15). Other studies in low-resource

settings have found 1.5% of fistula patients had a peripartum hysterectomy (12), much lower than the rate seen in our population (17.8%). Peripartum hysterectomy is known to increase the risk of urinary tract injury, and our results demonstrate a strong association between hysterectomy and high fistula location (16).

While it is possible for a woman to develop a fistula before a cesarean delivery is performed, the location of these injuries and short duration of labor in this study population lead us to speculate that many of these injuries were iatrogenic. The multiparous women in our study developed a fistula despite laboring for less than a day and often delivering a live-born infant. Self-report of labor duration may be imprecise, but survival of the infant for many of these women highlights that the fetus was not anoxic for a long period of time. In these cases, the injury to the urogenital tract is likely not due to prolonged pressure necrosis, but rather is more likely to be a result of surgical injury.

Conversely, among women who did not have a peripartum operation, higher parity was associated with increased odds of a fistula high in the urogenital tract. Since these are not iatrogenic, more research is needed to understand the cause of these high injuries.

The skill of the surgeon, adequate support staff, and proper operating theater equipment can play a significant role in decreasing iatrogenic injuries at the time of cesarean delivery. In Malawi, as in many countries in sub-Saharan Africa, most cesarean deliveries are performed by clinical officers who have variable levels of training and experience (17). Most providers receive minimal or no training in the evaluation of urinary tract injuries at the time of cesarean delivery, and specialized equipment to assess for these injuries, such as cystoscopy, is largely unavailable. Cesarean deliveries performed for prolonged, obstructed labor can be difficult even for the seasoned obstetrician.

Conclusion

This study demonstrates that a woman continues to be at risk for developing an OF in low-resource settings even after her first delivery. As the number of cesarean deliveries increases, the quality of this surgical care must be maintained at a high level in order to prevent complications. Prevention of OF must involve a multi-dimensional approach and cannot be accomplished only by making cesarean deliveries more available or by solely focusing on interventions at a woman's first delivery. Previous public health interventions in low- and middle-income countries have targeted prevention of child marriage, delaying first pregnancy, and improving access to quality surgical care (19, 20). These interventions are critical, but to eliminate the burden of OF in low-resource settings, attention must also focus on the quality of the surgical care and reduction of risks related to cesarean delivery and peripartum hysterectomy (12, 17).

Acknowledgments

Funding

Funding for this study was provided by the Freedom from Fistula Foundation, the University of North Carolina Department of OB-GYN, and the Doris Duke Charitable Foundation.

We are grateful to the following individuals for their contributions to the study: William Nundwe, Sandra Ngwira, Sella Chisanga, Julia Ryan, Angela Bengtson, Laura Drew, and William Miller; and to all the women who participated in this study.

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Figure 1. Flowchart of patients included in vesicovaginal fistula location analysis
 OF: obstetric fistula; VVF: vesicovaginal fistula; RVF: rectovaginal fistula

Table 1

Characteristics at time of baseline survey comparing primiparous and multiparous women presenting for repair

	Total n = 452	Primiparous at index delivery n = 196 (43.4)	Multiparous at index delivery n = 256 (56.6)	P value
Age at presentation, median [IQR]	32 [26 – 42]	29 [22–37]	35 [30–45]	<0.001 ^a
Missing, n	4	3	1	
Currently menstruating, n (%)				0.001 ^b
Yes	195 (43.6)	104 (53.6)	91 (36.0)	
No	252 (56.4)	90 (46.4)	162 (64.0)	
Doesn't know/missing, n	5	2	3	
Number of living children, median [IQR]	1 [0 – 3]	0 [0–1]	2 [1–4]	<0.001 ^a
Doesn't know/missing, n	8	0	8	
Age when fistula formed, median [IQR]	22 [19–30]	19 [17–20]	28 [24–33.5]	<0.001 ^a
Doesn't know/missing, n	62	22	40	
Age at first marriage, median [IQR]	18 [17 – 20]	18 [16–19]	18 [17–20]	0.044 ^a
Doesn't know/missing, n	129	48	81	
Currently married, n (%)				0.002 ^b
Yes	283 (63.0)	107 (54.9)	176 (69.3)	
No	166 (37.0)	88 (45.1)	78 (30.7)	
Doesn't know/missing, n	3	1	2	
Residence, n (%)				0.662 ^b
Rural	425 (94.9)	186 (95.4)	239 (94.5)	
Urban	23 (5.1)	9 (4.6)	14 (5.5)	
Doesn't know/missing, n	4	1	3	
Roof type, n (%)				0.341 ^b
Grass/none	359 (81.6)	152 (79.6)	207 (83.1)	
Metal/wood/cement	81 (18.4)	39 (20.4)	42 (16.9)	
Doesn't know/missing, n	12	5	7	
Education, n (%)				0.161 ^b
None	143 (32.3)	53 (27.9)	90 (35.7)	
Some Primary education	273 (61.8)	127 (66.8)	146 (57.9)	
Some Secondary	26 (5.9)	10 (5.3)	16 (6.4)	
Doesn't know/missing, n	10	6	4	
Occupation, n (%)				0.031 ^c
Peasant farmer	328 (74.7)	132 (69.1)	196 (79.0)	
Housewife/caretaker	40 (9.1)	20 (10.5)	20 (8.1)	
Small business owner	40 (9.1)	21 (11.0)	19 (7.7)	
Unemployed	18 (4.1)	12 (6.3)	6 (2.4)	
Commercial farmer	5 (1.1)	0 (0.0)	5 (2.0)	
Other	9 (2.0)	7 (3.1)	2 (0.8)	

	Total n = 452	Primiparous at index delivery n = 196 (43.4)	Multiparous at index delivery n = 256 (56.6)	P value
Doesn't know/missing, n	12	4	8	
HIV Status, n (%)				0.169 ^b
Positive	37 (8.3)	19 (9.9)	16 (6.3)	
Negative	409 (91.7)	173 (90.1)	236 (93.7)	
Missing, n	8	4	4	
Height, n (%)				0.242 ^b
<145 cm	63 (15.5)	31 (17.9)	32 (13.7)	
145 cm	344 (84.5)	142 (82.1)	202 (86.3)	
Missing, n	45	23	22	
BMI, n (%)				0.013 ^b
<18.5	43 (10.6)	26 (15.0)	17 (7.3)	
18.5	362 (89.4)	147 (85.0)	215 (92.7)	
Not assessed, n	47	23	24	
Duration of labor, n (%)				<0.001 ^b
< 24 hours	220 (54.7)	77 (44.5)	143 (62.4)	
24 hours	182 (45.3)	96 (55.5)	86 (37.6)	
Doesn't know/missing, n	50	23	27	
Status of fetus at delivery, n (%)				0.026 ^b
Still birth	347 (77.1)	161 (82.1)	186 (73.2)	
Live birth	103 (22.9)	35 (17.9)	68 (26.8)	
Missing, n	2	0	2	
Delivery location, n (%)				0.199 ^a
Health facility	399 (89.4)	169 (87.2)	230 (91.0)	
Home	48 (10.6)	25 (12.8)	23 (9.0)	
Missing	5	2	3	
Had peripartum operation, n (%)				0.060 ^b
Yes	251 (55.5)	99 (50.5)	152 (59.4)	
No	201 (44.5)	97 (49.5)	104 (40.6)	
Missing, n	0	0	0	
Mode of delivery, n (%)				0.122 ^b
Cesarean	247 (54.7)	99 (50.1)	148 (57.8)	
Vaginal or Operative	205 (45.4)	97 (49.5)	108 (42.2)	
Missing, n	0	0	0	
Hysterectomy at delivery, n (%)				<0.001 ^b
Yes	72 (17.8)	13 (7.2)	59 (26.3)	
No	332 (82.2)	167 (92.8)	165 (73.7)	
Doesn't know/missing, n	48	16	32	
Presented for repair within a year, n (%)				0.002 ^b
Yes	120 (30.9)	39 (22.5)	81 (37.5)	

	Total n = 452	Primiparous at index delivery n = 196 (43.4)	Multiparous at index delivery n = 256 (56.6)	P value
No	269 (69.1)	134 (77.5)	135 (62.5)	
Missing, n	63	23	40	
Presented with OF diagnosis, n (%)				
Yes	290 (64.6)	134 (68.4)	156 (61.7)	0.141 ^b
No	159 (35.4)	62 (31.6)	97 (38.3)	
Missing, n	3	0	3	
Had previous operation for OF, n (%)				
Yes	107 (23.8)	58 (29.9)	49 (19.1)	0.008 ^b
No	343 (76.2)	136 (70.1)	207 (80.9)	
Missing, n	2	2	0	
Location of fistula, n (%)				<0.001 ^b
Low	334 (73.9)	174 (88.8)	160 (62.5)	
High	118 (26.2)	22 (11.2)	96 (37.5)	
Missing	0	0	0	

^aMann-Whitney U,

^bChi-square, and

^cFisher's exact tests were used. Column totals may not equal column Ns due to missing data.

Table 2

Predictors of high fistula location comparing characteristics at index delivery

	OR	95% CI	aOR	95% CI
Multiparity (n = 390)	5.73	3.27– 10.03	4.55 ^a	2.27 – 9.12
Labor Duration <24 hr (n = 402)	0.82	0.52 – 1.30	1.09 ^b	0.67 – 1.78
Peripartum operation (n = 400)	3.51	2.09 – 5.88	3.88 ^c	2.27 – 6.63
Cesarean delivery (n = 450)	3.67	2.27 – 5.94	4.11 ^d	2.45 – 6.89
Hysterectomy (n = 402)	3.03	1.77 – 5.17	2.58 ^d	1.46 – 4.58
Live-born infant (n = 450)	2.40	1.50 – 3.84	2.77 ^e	1.68 – 4.57

Ns vary in each model due to missing data.

^a Adjusted for age at delivery;^b Adjusted for parity;^c Adjusted for live-born infant and labor duration^d Adjusted for parity and live-born infant;^e Adjusted for delivery mode