



Twelve Years of Managing Female Urogenital Fistula in Uganda: Characteristics, Repair Outcomes, and Predictors for Success in a Multicentre Cohort Study

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Abstract

Introduction and Hypothesis To describe the characteristics and aetiology of urogenital fistula, and to determine the predictors for successful repair.

Methods We conducted a multicentre retrospective cohort study using prospectively collected data of women who underwent urogenital fistula repair at four regional repair centres between 2010 and 2021. The fistulae were classified as ischaemic (urethrovaginal and vesicovaginal), iatrogenic (vesico-cervical, vesico-uterine, vaginal vault fistula, and ureteric fistula) and congenital. The patients were followed up at 3 months postoperatively to assess surgical outcomes. Successful repair was defined as fistula closure with urinary continence, while unsuccessful repair included failed fistula closure or residual urethral incontinence. Modified Poisson regression was used to estimate adjusted risk ratios (aRR) for predictors of successful repair.

Results A total of 510 women were included. The mean age was 32.7 ± 12.5 years. The most common fistula type was urethrovaginal (34.9%). Successful repair was achieved in 80.8% (95% CI 77–84). Women with urethrovaginal fistula (aRR 0.18; 95% CI 0.1–0.4; $p < 0.001$), previous fistula repair (aRR 0.44; 95% CI 0.25–0.79; $p = 0.005$), and those who were divorced (aRR 0.47; 95% CI 0.27–0.83; $p = 0.009$) were less likely to have successful repair. In contrast, grand multiparity was associated with a higher likelihood of success (aRR 2.4; 95% CI 1.08–5.2; $p = 0.03$).

Conclusion Fistula repair outcomes were favourable, with a high success rate. Urethrovaginal fistula, previous repair, and divorce were associated with lower likelihood of success. These findings highlight the need for careful patient selection and specialised expertise in the management of complex fistulae.

Keywords Genitourinary fistula · Obstetric fistula · Surgical outcomes · Fistula repair · Uganda

Introduction

Female urogenital fistula is a devastating condition characterised by an abnormal communication between the urinary tract and the genital tract, resulting in continuous leakage of urine through the vagina [1]. Although earlier estimates suggested that 2–3 million women may be living with untreated fistula globally, more recent population-based modelling studies estimate a substantially lower burden of approximately 457,000 cases [2]. The condition remains an important marker of inequities in health systems, with the highest burden reported in sub-Saharan Africa (SSA) and parts of South Asia [2–4]. In Uganda, over 100,000 women are estimated to be living with untreated urogenital fistulae, while approximately 1700 repair surgeries are performed

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annually, highlighting a substantial backlog and persistent gaps in access to specialised surgical care [5].

In low-resource settings, most female urogenital fistulae arise from prolonged obstructed labour, during which sustained pressure of the foetal head against maternal pelvic tissues leads to ischemic necrosis of the bladder, urethra, and vagina [6]. This process commonly results in vesicovaginal or urethrovaginal fistula and is frequently associated with stillbirth and severe maternal morbidity [6]. In addition to physical disability, women affected by fistula often experience profound psychosocial consequences, including social stigma, marital breakdown, economic deprivation, and mental health disorders. Although obstetric causes continue to predominate in many low-income settings, increasing attention has been drawn to the rising contribution of iatrogenic fistula resulting from obstetric and gynaecological surgical procedures such as caesarean section and hysterectomy [5, 7–9]. This shift in aetiology likely reflects increasing access to obstetric and gynaecological surgery in health systems where surgical training, supervision, and quality assurance remain variable [7].

Surgical repair remains the definitive treatment for the closure of urogenital fistulae and can restore continence when successful; however, recovery of dignity, wellbeing, and social reintegration for affected women often requires additional comprehensive psychosocial and socioeconomic support. Successful closure of the fistula with restoration of continence has been reported in approximately 42–98.5% of cases when experienced surgeons perform repairs [10, 11]. Nevertheless, surgical outcomes vary widely depending on factors such as fistula size, location, urethral involvement, vaginal scarring, and prior attempts at repair. Urethral involvement, circumferential defects, and repeat surgeries have been identified as predictors of poor surgical outcomes and persistent urinary incontinence following repair [12–14].

Despite global initiatives aimed at eliminating obstetric fistula, including the United Nations Campaign to End Fistula, access to specialised surgical care remains limited in many high-burden settings. Surgical repair services are often delivered through short-term fistula surgical camps or outreach programmes due to the scarcity of trained fistula surgeons and dedicated treatment centres. Furthermore, there is a paucity of long-term programmatic data describing fistula characteristics, surgical outcomes, and predictors for successful repair from many countries in SSA [15]. Such evidence is essential to guide surgical training, improve patient selection, and optimise outcomes.

Despite the substantial burden of female urogenital fistula in Uganda [5], few studies have reported on multicentre outcomes over extended periods. Understanding the characteristics of women presenting with urogenital fistula and the predictors for successful repair is essential for improving surgical outcomes and strengthening fistula care services.

Therefore, this study aimed to describe the characteristics of women undergoing urogenital fistula repair, determine surgical outcomes, and identify predictors of successful repair among women managed at different regional fistula repair centres in Uganda.

Methods

Study Design and Study Setting

This was a multicentre retrospective cohort study using prospectively collected data with standardised data collection tools from women who underwent surgical repair for urogenital fistula at four regional fistula repair centres in Uganda between January 2010 and December 2021, representing a 12-year period of surgical care.

Fistula repair services were delivered through multiple fistula repair surgical camps conducted at these regional centres during the study period. These camps were organised by the fistula surgery team of a teaching institution in Uganda in collaboration with local hospital teams and were designed to provide concentrated specialist surgical care for women with fistula and other pelvic floor disorders such as pelvic organ prolapse and obstetric sphincter injuries who are identified and referred from surrounding catchment areas. Women learnt about the dates and venues of the fistula repair camps through radio, community, and poster announcements. Participants were followed prospectively for 3 months after surgery to assess surgical outcomes. The camps were conducted by surgeons from the teaching institution's dedicated fistula repair team, comprising five certified urogynaecologists who had fistula surgery as part of their fellowship training, with periodic support from visiting international surgeons. The surgeons had at least five years' experience in fistula surgery. The surgeons conducted the preoperative assessment and evaluation, and performed the repairs.

Study Population and Recruitment

Women diagnosed with urogenital fistula who underwent surgical repair at any of the sites during the study period were eligible for inclusion. Eligible fistula types included urethrovaginal, vesicovaginal, vesicocervical, vesicouterine, vaginal vault, and ureteric fistula. Women who underwent surgical repair during the study period and had complete outcome data at 3 months were included in the analysis. Women with missing outcome data at 3 months were excluded.

Diagnosis of Urogenital Fistula

The diagnosis of urogenital fistulae was made by the surgical team based on clinical history and physical examination.

Women typically presented with a history of urine leakage following childbirth or pelvic surgery. Clinical assessment included digital and speculum examination to identify the location and characteristics of the fistula. In cases where the fistula could not be clearly identified, such as pinhole, ureteric, vesicocervical, or vesicouterine fistulae, methylene blue test was performed. This was done by instilling between 60 and 120 mls of methylene blue into the bladder through a urethral catheter using a 60 ml syringe. A Sim's speculum was used to visualise the anterior vaginal wall and cervix where it was present. The test was considered positive if the methylene blue was seen leaking through the vagina or cervix, confirming a communication between the bladder and genital tract. A positive test confirmed diagnosis of pinhole fistulae, vesicocervical, vesicouterine, and vault fistula. A negative methylene blue test was when there was no methylene blue leaking in the vagina or cervix and this signified a probable presence of ureteric fistula or urethral incontinence. Ureteric fistula was diagnosed on the basis of a combination of negative methylene blue test, three swab test showing wet swabs consistent with urine leakage and pelvic imaging (abdominal ultrasound scan for presence of hydronephrosis and intravenous pyelogram to detect the side and site of injury). Phenazopyridine hydrochloride was not administered to colour the urine because it is difficult to find in our setting. We therefore determined a fistula solely based on the swab wetness.

Classification of Urogenital Fistula

The fistulae were classified according to both aetiology and anatomical location. Aetiologically, fistulae were categorised as ischemic, iatrogenic, or congenital. A fistula was classified as iatrogenic if a woman had any of the following fistulae after an obstetric or gynaecological surgery: ureteric, vesicocervical, vesicouterine, or vaginal vault fistula. Vesico-vaginal and urethro-vaginal fistula with or without prior pelvic surgery were classified as ischemic [16]. Congenital fistulae were considered if the participant had any of these fistulae since birth. According to location, the fistulae were classified into vesico-vaginal, vesico-cervical, vesicouterine, vaginal vault, urethro-vaginal, and ureteric fistula [17]. This was done by measuring the distance of the fistula from the external urethral orifice. A fistula that was within 5 cm (cm) of the external urethral orifice was classified as urethro-vaginal, while one that was more than 5 cm from the external urethral orifice but in front of the cervix was classified as vesico-vaginal.

Surgical Procedures

All participants underwent surgical repair of the urogenital fistula after providing informed consent. The type and route

of surgery depended on the type and anatomical location of the fistula. The vaginal approach was used for the low urogenital fistulae (urethrovaginal, vesicovaginal, some vesicocervical and vaginal vault fistulae), whereas the abdominal route was used for high urogenital fistulae (ureteric, vesicouterine, and vesicocervical where the cervix was fixed). The final decision regarding the operative route was made after examination under anesthesia. Vesicovaginal fistulae repaired vaginally were managed using the conventional transvaginal flap-splitting technique, which involves a circumferential incision around the fistula, wide mobilisation of the vaginal epithelium off the bladder for a distance of about 2–3 cm in all directions, excision of the fibrotic tissue around the fistula, and tension-free layered closure using vicryl 2/0 suture [18]. The ureteric fistulae were managed by laparotomy with ureteric re-implantation, with or without a Boari flap. We followed the routine postoperative care protocol of the fistula programme for all patients at all the centres which included: an indwelling urethral catheter for at least 14 days, monitoring for urine leakage, antibiotics, analgesia, hydration, perineal hygiene, and early ambulation. Antibiotics used included oral metronidazole 500 mg every 8 h and amoxycillin 500 mg every 8 h for 5 days for those that had surgery through the vaginal route. For patients whose fistula was repaired through the abdominal route, intravenous metronidazole (500 mg every 8 h) and ceftriaxone (2 g once daily) were administered for 3 days. The analgesia that was provided was oral paracetamol (1 g every 8 h for 5 days) for those that had surgery through the vaginal route while in those that had a laparotomy, intravenous paracetamol 1 g every 6 h for the first 2 to 3 days was given, followed by oral paracetamol for a further 3 to 5 days. Drug doses were adjusted where necessary according to individual patient response. Patients remained hospitalised until removal of the Foley catheter. A methylene blue test was performed prior to catheter removal to assess repair integrity before discharge.

Follow-up and Outcome Assessment

Participants were followed up to 3 months after surgery to assess the outcomes. The follow-up visits were scheduled at the respective repair centres. To enhance follow-up completion, participants were contacted by phone call approximately 1 week prior to their scheduled follow-up appointment as a reminder. For participants who could not initially be reached, tracing was undertaken using next of kin contact information recorded in the programme database. This was done to minimise loss to follow-up. At the follow-up visit, participants underwent clinical assessment to determine the outcome. They were asked if they were still leaking or dry. A methylene blue dye test, as described earlier was performed to assess repair integrity. A positive test indicated persistent fistula, while a negative test either indicated successful

closure in those that were dry/continent or residual post-repair stress urinary incontinence in those that still reported urine leakage. Residual post-repair stress urine incontinence was further evaluated using a cough stress test.

The primary outcome was successful fistula repair, defined as the absence of urinary leakage and a negative methylene blue dye test at 3 months. Unsuccessful repair was defined as either failed fistula closure or residual post-repair stress urine incontinence. Residual post-repair urine incontinence was defined as persistent urinary leakage despite successful fistula closure, as evidenced by a negative dye test and a positive cough stress test. Failed fistula closure was defined as persistent urinary leakage with a positive methylene blue test.

Data Collection Tool

Data were extracted from prospectively collected patient medical records using a standardised data collection tool at all study sites completed by trained research assistants, including nurses and surgeons involved in the fistula repair programme. The tool captured baseline characteristics, intra-operative findings, and postoperative outcomes.

The baseline characteristics included socio-demographic and clinical variables such as age at fistula development, marital status, and duration with fistula. Obstetric characteristics included mode of antecedent delivery, occurrence of ruptured uterus, and outcome of delivery (live birth, still birth, or early neonatal death). Gynaecological characteristics included parity at fistula development, antecedent pelvic surgery (abdominal or vaginal hysterectomy). Fistula characteristics included type (urethrovaginal, vesicovaginal, vesicouterine, vaginal vault, and ureteric fistula), and aetiology (ischemic, iatrogenic, and congenital). Intra-operative variables included surgical procedure performed, route of surgery, duration of surgery, and intraoperative complications. Hemorrhage was defined as intraoperative or postoperative bleeding that necessitated transfusion. Postoperative variables included complications, length of postoperative hospital stay, and surgical outcomes.

Statistical Analysis

Data were entered into REDCap and exported to Stata 17 (StataCorp, LLC, College Station, TX, USA) for analysis. Categorical data were presented as frequencies and percentages, while continuous variables were summarised using means with standard deviations or medians with interquartile ranges as appropriate.

The successful fistula repair rate was calculated by dividing the number of women who were continent of urine with a negative methylene blue test at 3 months among those who attended follow-up, expressed as a percentage.

Differences in demographic and clinical characteristics between women with successful repair and those without successful repair were assessed using the chi-square test or Fisher's exact test for categorical variables. Continuous variables were compared using the Wilcoxon rank-sum test for non-normally distributed continuous variables and Student's *t*-tests for normally distributed continuous variables.

Predictors for successful fistula repair were assessed using modified Poisson regression with robust standard errors to estimate risk ratios. Univariable analysis was first performed to estimate crude risk ratios (RRs) and 95% confidence intervals (CIs). Variables with $p < 0.20$ in univariable analysis were included in the multivariable model to estimate adjusted risk ratios (aRRs) and 95% CIs for predictors of successful repair. A p value < 0.05 was considered statistically significant. Missing data were handled using complete-case analysis.

Results

Participants

A total of 510 women with urogenital fistula who underwent surgical repair during the study period were included. There was no missing data for all variables, and there was no loss to follow-up.

Sociodemographic Characteristics of the Study Participants

The mean age was 32.7 ± 12.5 years, and multiparous women represented the largest parity group at fistula development (38.2%). Most of the participants were married (59.5%) and had the fistula for more than 1 year (57.5%), with a mean duration of 6.15 ± 9.30 years (Table 1). Women with unsuccessful fistula repair were frequently older, divorced or separated or widowed, primiparous, and had a longer duration with fistula compared with those with successful repair (Table 1).

Perioperative Fistula Characteristics

The most common fistula type was urethrovaginal (34.9%), followed by vesicovaginal (31%). Most of the fistulae were ischaemic (66.1%) while 32.7% were iatrogenic and 1.2% congenital (due to ectopic ureters draining in the vagina). Most surgeries were primary repairs (71.8%) and were performed through the vaginal route (75.9%); 20.8% of the surgeries were done abdominally and 3.3% were performed using a combined approach (Both vaginal and abdominal). Perioperative complications were uncommon with only 7.1% of women experiencing complications. The most common

Table 1 Participant sociodemographic characteristics, $N=510$

Characteristics	Total $N=510$ N (%)	Fistula repair outcome		p -value
		Successful $n=412$ n (%)	Unsuccessful $n=98$ n (%)	
Age, mean (SD)	32.76 (12.54)	32.21 (12.53)	35.07 (12.37)	0.042 ^a
Age in years				0.051
	< 25	149 (29.2)	123 (29.9)	26 (26.5)
	25–35	154 (30.2)	132 (32.0)	22 (22.4)
	> 35	207 (40.6)	157 (38.1)	50 (51.0)
Marital status				< 0.001
	Single	56 (11.0)	45 (10.9)	11 (11.2)
	Married	304 (59.6)	265 (64.3)	39 (39.8)
	Divorced/separated/widowed	150 (29.4)	102 (24.8)	48 (49.0)
Parity at fistula development				0.004
	Primipara (1)	173 (33.9)	126 (30.6)	47 (48.0)
	Multipara (2–4)	195 (38.2)	163 (39.6)	32 (32.7)
	Grand multipara (≥ 5)	142 (27.8)	123 (29.9)	19 (19.4)
Duration with fistula				< 0.001
	< 3 months	73 (14.3)	66 (16.0)	7 (7.1)
	3 months–1 year	144 (28.2)	128 (31.1)	16 (16.3)
	≥ 1 year	293 (57.5)	218 (52.9)	75 (76.5)
Duration with fistula (years), Mean (SD)	6.15 (9.30)	5.30 (8.89)	9.74(10.3)	< 0.001 ^a

SD standard deviation

^a p values from the Student's test, while all other unmarked p values from the chi-square test

perioperative complication encountered was haemorrhage (4.9%) (Table 2).

Surgeries Leading to Iatrogenic Fistulae

Among the 167 women with iatrogenic fistulae, the most common preceding operation was caesarean section (120/167, 71.9%), followed by obstetric hysterectomy (34/167, 20.4%), and gynaecological hysterectomy (13/167, 7.8%). The indications for these procedures are presented in Table 3.

Outcome of Surgery

Of the 510 women who underwent fistula repair in the study period, 412 had successful fistula repair with continence, corresponding to an overall success rate of 80.8% (95% CI 77–84). Among the 98 women with unsuccessful repair, 68 (13.3%) had urethral incontinence despite successful fistula closure, while 30 (5.8%) had failed fistula closure.

Predictors for Successful Fistula Repair

Urethrovaginal fistula (aRR 0.18; 95% CI 0.1–0.4; $p < 0.001$), previous fistula repair (aRR 0.44; 95% CI

0.25–0.79; $p = 0.005$), and being divorced, separated, or widowed (aRR 0.47; 95% CI 0.27–0.83; $p = 0.009$) were associated with a lower likelihood of successful repair. In contrast, grand multiparity was associated with a higher likelihood of successful repair (aRR 2.4; 95% CI 1.08–5.2; $p = 0.03$). Other variables, including age, duration of fistula, and surgical approach, were not independently associated with successful repair (Table 4).

Discussion

In this multicentre cohort of 510 women undergoing urogenital fistula repair over 12 years in Uganda, successful fistula closure with continence was achieved in 80.8% of cases. Most fistulae were ischaemic (66.1%), although nearly one-third were iatrogenic. Urethrovaginal fistula was the most common type. Urethrovaginal fistula, previous repair attempts, and being divorced, separated, or widowed were associated with a lower likelihood of successful repair, while grand multiparity was associated with a higher likelihood of successful repair.

The mean age of participants in this study was 32.7 years, with the majority of women presenting after living with a fistula for more than 1 year and an average duration of

Table 2 Perioperative characteristics of the study participants, *N* = 510

Characteristics		Fistula repair			<i>p</i> -value
		Total	Successful	Unsuccessful	
		<i>N</i> = 510	<i>N</i> = 412	<i>N</i> = 98	
		<i>N</i> (%)	<i>n</i> (%)	<i>n</i> (%)	
Type of fistula					< 0.001 ^b
	Vesico—vaginal	158 (31.0)	142 (34.5)	16 (16.3)	
	Vesico—uterine	25 (4.9)	23 (5.6)	2 (2.0)	
	Vesico—cervical	72 (14.1)	70 (17.0)	2 (2.0)	
	Urethro-vaginal	178 (34.9)	106 (25.7)	72 (73.5)	
	Ureteric	47 (9.2)	44 (10.7)	3 (3.1)	
	Vault Fistula	30 (5.9)	27 (6.6)	3 (3.1)	
Fistula aetiology					< 0.001 ^b
	Ischaemic	337 (66.1)	249 (60.4)	88 (89.8)	
	Iatrogenic	167 (32.7)	157 (38.1)	10 (10.2)	
	Congenital	6 (1.2)	6 (1.5)	0 (0.0)	
Type of fistula surgery					< 0.001
	Primary repair	366 (71.8)	322 (78.2)	44 (44.9)	
	Repeat repair	144 (28.2)	90 (21.8)	54 (55.1)	
Number of repeat fistulae repairs ^a					< 0.001 ^b
	1	11 (7.6)	9 (10)	2 (4)	
	2–3	102 (70.8)	72 (80)	30 (56)	
	≥ 4	31 (21.5)	9 (10)	22 (41)	
Route of surgery					0.006
	Vaginal	387 (75.9)	303 (73.5)	84 (85.7)	
	Abdominal	106 (20.8)	97 (23.5)	9 (9.3)	
	Combined approach	17 (3.3)	12 (2.9)	5 (5.2)	
Perioperative complications					0.369 ^b
	No complication	474 (92.9)	387 (93.9)	87 (88.8)	
	Haemorrhage	25 (4.9)	18 (4.4)	7 (7.1)	
	Wound infection	9 (1.8)	6 (1.5)	3 (3.1)	
	Ureteric injury	2 (0.4)	1 (0.2)	1 (1.0)	

^aNumber of repeat fistula surgeries was only assessed for participants who had repeat surgeries (*n* = 144)^b*p* values from Fisher's exact test, while all other unmarked *p* values from the chi-square test**Table 3** Types of surgery leading to genitourinary fistula

Type of operation (<i>n</i> = 167)	Indications	Frequency	Percentage (%)
Cesarean section (<i>n</i> = 120, 71.9%)	Labour dystocia	73	60.8%
	Repeat CS	22	18.3%
	Transverse lie	15	12.5%
	Others ^a	10	8.3%
Obstetric hysterectomy (<i>n</i> = 34, 20.4%)	Ruptured uterus	30	88.2%
	Post-partum hemorrhage	1	2.9%
	Puerperal sepsis	3	8.8%
Gynecological hysterectomy (<i>n</i> = 13, 7.8%)	Uterine fibroids	11	84.6%
	Pelvic organ prolapse	1	7.7%
	Cervical cancer	1	7.7%

CS Cesarean section

^aOthers refers to other cesarean section indications which included: fetal distress (5), fetal macrosomia (2), intra-uterine growth restriction (1), pre-eclampsia (1), extreme prematurity (2)

Table 4 Predictors for successful fistula repair, $N=510$

Characteristics		Successful repair $n=412$ n (%)	Unadjusted risk ratio (95% CI)	p value	Adjusted risk ratio (95% CI)	p value
Age in years	25–35	132 (32.0)	Ref		Ref	
	< 25	123 (29.9)	0.79(0.42,1.46)	0.451	1.23 (0.56,2.72)	0.601
	> 35	157 (38.1)	0.52(0.30,0.91)	0.022*	0.54 (0.27,1.10)	0.094
Marital status	Married	265 (64.3)	Ref		Ref	
	Single	45 (10.9)	0.60(0.29,1.26)	0.179	0.96 (0.39,2.36)	0.938
	Divorced/separated/widowed	102 (24.8)	0.31(0.19,0.51)	<0.001*	0.47 (0.27,0.83)	0.009*
Parity at fistula development	Primipara (1)	126 (30.6)	Ref		Ref	
	Multipara (2–4)	163 (39.6)	1.90 (1.15,3.15)	0.013*	1.60 (0.86,2.97)	0.135
	Grand multipara (≥ 5)	123 (29.9)	2.41 (1.34,4.35)	0.003*	2.37 (1.08,5.20)	0.032*
Type of fistula	Vesico—vaginal	142 (34.5)	Ref		Ref	
	Vesico—uterine	23 (5.6)	1.41 (0.31,6.47)	0.66	2.78 (0.46,16.97)	0.267
	Vesico—cervical	70 (17.0)	8.57(1.12,65.50)	0.038*	4.68 (0.87,25.02)	0.072*
	Urethro-vaginal	106 (25.7)	0.18 (0.10,0.32)	<0.001*	0.18 (0.10,0.35)	<0.001**
	Ureteric	44 (10.7)	1.80 (0.51–6.38)	0.365	2.60 (0.47,14.49)	0.276
	Vault fistula	21 (6.6)	1.29 (0.28,5.94)	0.748	1.14 (0.28,4.65)	0.856
Surgical approach	Vaginal	303 (73.5)	Ref		Ref	
	Abdominal	97 (23.5)	2.95 (1.43,6.09)	0.003*	0.35 (0.10,1.18)	0.09
	Combined	12 (2.9)	0.66 (0.23,1.92)	0.443	0.36 (0.08,1.65)	0.187
Type of surgery	Primary repair	312 (77.8)	Ref		Ref	
	Repeat repair	89 (22.2)	0.22 (0.14,0.35)	<0.001**	0.44 (0.25,0.79)	0.005*
Duration of fistula	< 3 months	66 (16.0)	Ref		Ref	
	3 months–1 year	128 (31.1)	1.18 (0.46,3.01)	0.731	1.14 (0.40,3.22)	0.807
	≥ 1 year	218 (52.9)	0.36 (0.20,0.65)	0.001*	1.22 (0.44,3.36)	0.703

* $p < 0.05$, ** $p < 0.001$, 95% CI 95% confidence interval^a p values

over 6 years. This prolonged duration before repair likely reflects persistent barriers to accessing fistula care in many low-resource settings, including limited awareness of treatment availability, financial constraints, social stigma, and the shortage of trained fistula surgeons [19–22]. Additionally, most fistula repair services in Uganda are often delivered through periodic surgical camps, which may contribute to delays in accessing treatment [5]. Similar delays have been reported in findings from previous studies where women often live with a fistula for several years before receiving surgical treatment [13, 22–24]. These delays contribute to worsening tissue damage, vaginal scarring, and increased surgical complexity, which may adversely affect repair outcomes.

In this cohort, ischaemic fistulae accounted for two-thirds of all cases, consistent with reports from other studies in sub-Saharan Africa, where obstructed labour remains the leading cause of urogenital fistula [6]. However, nearly one-third of the fistulae in this study were iatrogenic, highlighting a growing contribution of iatrogenic fistula in low-resource settings [5, 7–9]. This likely reflects increased

access to caesarean section in settings where surgical training, supervision, and health system capacity remain uneven [7, 9].

Urethrovaginal fistula was the most common type observed in this study, followed by vesicovaginal fistula. This predominance likely reflects severe ischemic injury associated with prolonged obstructed labour, during which the foetal head compresses the urethra and bladder neck against the pubic symphysis [6, 25]. Such injury often results in extensive damage to the urethral continence mechanism, making surgical repair technically challenging and increasing the risk of residual incontinence [12–14]. Similar patterns have been reported in fistula repair programmes across Africa, where urethral involvement is frequently associated with complex fistulae and poor surgical outcomes [13, 26].

The overall successful repair rate of 80.8% observed in this study is comparable to outcomes reported in other fistula repair programmes in sub-Saharan Africa. Systematic reviews have reported closure rates ranging from approximately 42% to 98.5% when surgery is performed by experienced fistula surgeons [10–12]. The success rate observed

in our study is slightly lower than the > 85% recommended by the World Health Organization for specialised fistula centres [27] which may reflect the inclusion of complex fistulae and a substantial proportion of repeat repairs in this cohort. Importantly, most unsuccessful repair outcomes in this study were a result of residual urethral incontinence. Persistent urinary incontinence despite successful fistula closure has been widely reported in the literature and is often attributed to damage to the urethral closing mechanism (the external urethral sphincter and urethral length) during the ischemic injury that also led to the fistula [13, 28, 29].

Women with urethrovaginal fistula were less likely to have successful fistula repair. This finding is consistent with previous studies demonstrating that urethral involvement significantly reduces the likelihood of successful fistula closure and continence restoration by 82% [13, 26, 30]. The ischaemic injury that occurs during prolonged obstructed labour usually leads to damage to critical components of the urinary continence mechanism (urethra, bladder neck, and the surrounding fascia). This injury can lead to extensive tissue loss and destruction resulting in a reduction in the urethral length and diameter, and scarring, which not only make repair technically challenging but also leads to eventual urethral incontinence even with successful fistula closure [12–14].

Previous fistula repair was also independently associated with unsuccessful repair, reducing the chances of success by 56%. Repeat surgeries are known to increase surgical complexity due to scar formation, distortion of normal anatomical planes, and reduced vascular supply to surrounding tissues [12, 13].

Women who were divorced or separated were less likely to experience successful repair. Although the reasons for this association are not fully clear, marital status may reflect broader social and economic vulnerabilities that influence access to care, duration of fistula before repair, and adherence to postoperative follow-up [19–22]. Women who experience marital dissolution following fistula may face increased social isolation and financial hardship, potentially affecting their ability to seek timely surgical care [22].

In contrast, grand multiparity was associated with a higher likelihood of successful repair. This finding may reflect differences in the mechanism of fistula formation. Primiparous women often develop fistula due to severe obstructed labour associated with cephalopelvic disproportion and prolonged compression of pelvic tissues, resulting in more extensive ischemic injury [6, 25]. This finding is consistent with findings from other studies done previously [31].

The findings of this study have important implications for fistula care programmes in low-resource settings. First, the high proportion of complex urethrovaginal fistulae and repeat repairs highlights the need for specialised surgical

expertise in managing these patients. Establishing regional centres of excellence and strengthening training programmes for fistula surgeons may help improve surgical outcomes. Second, the substantial proportion of iatrogenic fistulae observed in this study underscores the need to improve surgical safety during obstetric and gynaecological procedures through enhanced training, supervision, and quality-assurance mechanisms. Third, strengthening referral pathways for early fistula repair may help reduce surgical complexity and improve outcomes.

This study has several strengths. It represents one of the largest retrospective cohorts describing fistula repair outcomes in Uganda and provides insights from multiple repair centres over a 12-year period. The multicentre design improves the generalisability of the findings to other fistula repair programmes in the region. In addition, this study builds on previous work from our institution that evaluated predictors and outcomes of obstetric fistula repair among a smaller cohort of 77 women, extending this earlier work with a substantially larger sample size and a multicentre perspective. The structured follow-up procedures and active participant tracing also resulted in minimal loss to follow-up, strengthening the validity of the reported outcomes.

However, several limitations should be acknowledged. The study was conducted within fistula surgical camps, which may introduce selection bias as more complex cases may be referred to these centres. Secondly, although participants were followed up for 3 months, a longer follow-up would be important to assess long-term continence outcomes. In addition, some potential predictors of surgical success, such as fistula size and degree of vaginal scarring, were not evaluated. Thirdly, our aetiologic classification was based on clinical and anatomical locations of the fistula; therefore, in women who underwent caesarean section after prolonged obstructed labour, some overlap between ischemic and iatrogenic mechanisms may have occurred. We also did not report on patient-reported outcomes such as self-reported dryness, and satisfaction with surgery. Therefore, outcomes were limited to clinical assessment of fistula closure and continence status.

Conclusion

In this 12-year multicentre cohort of women undergoing urogenital fistula repair in Uganda, the overall surgical success rate was high, although a substantial proportion of patients experienced residual urethral incontinence. Urethrovaginal fistula, previous repair attempts, and divorced marital status were important predictors of unsuccessful repair, while grand multiparity was associated with improved outcomes. These findings provide important evidence to inform fistula

surgical training, patient selection, and programme planning in low-resource settings.

Authors' Contribution M Kayondo: Proposal development, Data collection, Data analysis and Manuscript writing.

T Margolis: Data collection, Manuscript writing and Manuscript editing.

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Declarations

Ethical Approval The study was part of a larger study on pelvic floor disorders that received approval from the Ethics committee of Mbarara University of Science and Technology (reference number- 17/08–18) and Uganda National Council for Science and Technology (reference number—HS368ES). We received site approval from all participating sites. Participants' privacy and confidentiality were ensured by using codes during data entry and not the names. The study utilised routinely collected clinical data from women managed as part of standard care during fistula repair camps. As this was a retrospective review of patient records, no additional consent for research or follow-up was obtained.

Conflicts of interest None.

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