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ORIGINAL RESEARCH

Short-Term Success Rate and Risk Factors for Failure of the Urethral Plication Procedure in the Management of Post-Obstetric Fistula Closure Stress Urinary Incontinence Among Ugandan Women: A Prospective Cohort Study

Musa Kayondo[1], Onesmus Byamukama[1], Brenda Ainomugisha[1], Rogers Kajabwangu[1], Paul Kato Kalyebara[1], Leevan Tibaijuka[1], Henry Mark Lugobe[1], Verena Alice Geissbuhler[2], Christopher Tarnay[3]

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Objective: To determine the six-month success rate and risk factors for failure of the urethral plication procedure in the management of post-obstetric fistula closure Stress Urinary Incontinence (SUI).

Methods: This was a prospective cohort study of 70 women with moderate or severe SUI who underwent surgery for post-obstetric fistula closure SUI using the urethral plication procedure, managed at eight fistula repair sites in Uganda. Participants underwent clinical evaluation, methylene blue dye testing, post-void residual assessment, and single-channel cystometry to confirm stress urinary incontinence and exclude residual fistula, overflow incontinence, and urge incontinence. Urethral plication was the primary continence procedure; however, in some participants, concomitant reconstructive procedures, including urethral elongation and urethral reconstruction were performed based on intraoperative anatomical findings. The participants were followed up for a period of six months. Assessment for statistically significant changes in the grade of SUI at baseline and at six months post-surgery among the failures was done using Bowker's test of symmetry and the Stuart–Maxwell test for marginal homogeneity. Descriptive analyses and multivariable log binomial regression were performed to determine risk factors for failure.

Results: A total of 70 women were enrolled with a mean age of 34 (SD ±12.1) years. Concomitant reconstructive procedures were performed in 26/70 (37%) of participants. The success rate at six months post-surgery was 61% (43/70) dropping from 70% (49/70) at time of discharge. Of the 27 participants who remained incontinent, 15 (56%) demonstrated improvement in the grade of incontinence (Bowker's test; $\chi^2 = 20.0$, $df = 3$, p = 0.0002, and Stuart–Maxwell test; $\chi^2 = 17.9$, $df = 2$, p = 0.0001). Severe vaginal scarring was the only independent risk factor (RR=3.77; 95% CI: 1.59–8.96; P=0.001).

Conclusion: The short-term success rate of the urethral plication procedure is moderately high, and in carefully selected women, it appears to be a safe and effective option for managing post-obstetric fistula closure stress urinary incontinence. Although the procedure is more likely to fail in women with severe vaginal scarring, the severity of the incontinence improves in those that fail.

Keywords: post-obstetric fistula closure stress urinary incontinence, urethral plication, success rate

Background

It is estimated that close to 2 million women in developing countries live with obstetric fistula and that there are 100,000 new cases annually.[1] Although successful fistula closure rates of 87% - 93% have been reported by various authors,[2–4]

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a number of women remain with persistent urethral incontinence even after successful obstetric fistula closure.[4–6] The causes of this post closure urethral incontinence (UI) include stress urinary incontinence (SUI), detrusor overactivity (urge incontinence) and overflow incontinence.[7]

UI remains a common and distressing complication affecting 16–55% of women after obstetric fistula closure.[4,8,9] Post-obstetric fistula closure UI is as distressing to the patient as a failed fistula closure often leading to profound social rejection, marital breakdown, economic dependency, and psychological trauma, which negatively impacts their quality of life.[8,10] These women often believe that the successful fistula closure was in fact a failure because the incontinence symptoms remain unchanged.[4,11,12]

Post-obstetric fistula closure SUI usually results from injury to either the urethra, bladder neck, and the surrounding tissues like the Pubo-vesical/ cervical fascia during prolonged obstructed labour. This injury may cause significant tissue loss that leads to reduction in urethral length, and increased urethral diameter, resulting in a reduction of the urethral pressure in comparison to the intravesical pressure. Damage to the bladder neck and the Pubo-vesical/ cervical fascia leads to post-obstetric fistula closure SUI as a result of loss of urethral support and mobility. Furthermore, the fistula repair process may also lead to post-obstetric fistula closure SUI. Repair of a urethro-vaginal fistula may lead to urethral shortening that results into a reduction in the urethral pressure or it may lead to urethral denervation that leads to intrinsic urethral dysfunction.[13,14]

Post-obstetric fistula closure SUI has been linked to several risk factors, including: young age at first delivery, primiparity, large or circumferential fistulae, urethral involvement (type IIA and IIB fistulas according to the Kees Waldjiik classification), and prior unsuccessful fistula repairs.[8,13,15]

Management of post-obstetric fistula closure SUI is challenging. Various treatment options have been reported but none have been overly successful.[14,16] Treatment options include conservative options like pelvic floor muscle training, and urethral caps. Surgical interventions include autologous fascial slings, pubococcygeal slings, bladder neck elevation, neourethral reconstruction, and urethral bulking agents.[17–19] However, many of these techniques are inaccessible in resource-limited settings due to cost and lack of surgeons with skills to perform them, and even when available, their use is limited by risks such as erosion, chronic pain, and infection.[19]

Urethral plication has been suggested as an option for surgical treatment of post-obstetric fistula closure SUI. The procedure involves doing a Urethrolysis and mobilization of the fascia laterally on the pelvic side walls on either side of the urethra and bladder neck, and pulling it across the midline over the urethra using multiple interrupted mattress PDS 0 sutures from top to bottom.[13,20,21] This procedure restores continence by increasing urethral resistance, and providing essential support to the urethra and the damaged sphincter mechanism. It is a simple, cost-effective, and context-appropriate technique that uses native tissues and basic surgical instruments making it especially suitable for low-resource settings. It can also be effectively combined with fibro-muscular slings or urethral elongation to enhance continence outcomes.[13,22]

However, there is a paucity of data on this procedure especially with regards to the success rate and the risk factors for failure with a few studies from Africa showing varying outcomes Previous studies from sub-Saharan Africa have reported variable continence outcomes, partly due to differences in patient selection, extent of tissue damage especially the urethra, and surgical options used (urethral plication, pubococcygeal sling, bladder neck procedures, and other reconstructive techniques).[16,18,19] While factors such as urethral involvement, circumferential injury, previous repairs, reduced urethral length, and severe vaginal scarring have been associated with residual urethral incontinence after fistula repair, limited evidence exists on the anatomical and clinical predictors of failure after urethral plication in surgery for post obstetric fistula urethral incontinence.[8,15,23,24] Furthermore, urethral plication may be insufficient as a stand-alone procedure in women with extensive tissue loss, short urethra, complete urethral loss, bladder neck involvement, and dense vaginal scarring, where additional procedures such as urethral elongation or reconstruction may be required to try and restore continence.[7,20,25]

Conceptually, post-obstetric fistula closure SUI occurs along a continuum of other tissue injury, anatomical disruption, and impaired continence mechanisms, all resulting from the prolonged obstructed labour. There may be damage to the urethra, bladder neck, Pubo-cervical fascia, and peri-urethral tissues, resulting in reduced urethral length, impaired urethral support, intrinsic sphincter dysfunction, scarring, and reduced bladder capacity.[15,26] These anatomical changes

not only influence the choice of continence procedure, but also the success. Therefore, evaluating urethral plication in this population not only requires consideration of overall continence rates, but also underlying anatomical factors that may modify surgical outcomes. Therefore, in this study, we aimed to determine the short-term outcomes of the urethral plication procedure, and the risk factors for failure in patients with post-obstetric fistula closure SUI at six-months post-surgery to inform evidence-based interventions aimed at reducing the high burden of this condition in this resource-limited setting.

Materials and Methods

Study Setting

The study was conducted during fistula repair camps at eight fistula repair sites in Uganda from December, 2019 to December, 2024. The sites included; Mbarara Regional Referral Hospital (MRRH), Lira Regional Referral Hospital (LRRH), Bwindi Community Hospital (BCH), Nakaseke General Hospital, Jinja Regional Referral Hospital, Masafu General Hospital, Buyinja Health Centre IV, and Hoima Regional Referral Hospital.

Study Design

This was a prospective cohort study among women with post-obstetric fistula closure Stress Urinary Incontinence (SUI) who were managed using urethral plication procedure and followed up to six-months post-surgery. Participants were recruited consecutively from women presenting with post-obstetric fistula closure urinary incontinence during fistula repair camps at the participating sites.

Study Population

All women diagnosed with post-obstetric fistula closure urethral incontinence (UI) were screened. Participants were considered to have post-obstetric fistula closure UI if they had all the following: complaint of urine incontinence, documented history of fistula surgery, and a negative methylene blue dye test. We enrolled only women with post-obstetric fistula closure stress urinary incontinence (SUI).

Inclusion Criteria

Women were included if they had a history of previous obstetric fistula repair performed at least four months earlier, persistent urinary leakage, a negative methylene blue dye test confirming fistula closure, and clinically confirmed moderate or severe stress urinary incontinence. We excluded women with Urge incontinence, overflow incontinence, and bladder stones. Women with mild SUI were managed conservatively and were not included in the surgical cohort.

Evaluation and Diagnosis of Post-Obstetric Fistula Closure SUI

The diagnostic evaluation followed a standardized clinical assessment protocol applied across the participating sites by trained fistula surgeons and urogynecologists. Women who met the enrolment criteria were evaluated clinically to confirm the diagnosis of post-obstetric fistula repair in a step-wise manner that included history, clinical examination and procedures like dye test, Post Void Residual (PVR), and single channel cytometry. The entire evaluation was explained to the patient and consent was obtained. A metallic catheter was inserted into the urinary bladder to assess for any bladder stones, and urethral patency. Thereafter, a methylene dye test was done to exclude presence of a residual fistula. A negative dye test indicated post-obstetric fistula closure UI. Overflow incontinence was assessed by measuring the PVR using the in-and-out catheterization method. A PVR > 150 mL indicated overflow incontinence. Urge incontinence/ overactive bladder was assessed using single channel cytometry and observing the fluid level in the open cylinder of a 60 mL syringe as described by Goh et al[26] If the level was > 15 cm with the bladder holding at least 300 mL of fluid and patient having urge symptoms, urge incontinence was diagnosed. If it was < 15 cm with no urge symptoms, urge incontinence was excluded and SUI suspected. The catheter was then removed without emptying the bladder and participant assessed for SUI. The participant was asked to cough and if there was leakage from the urethra, then a diagnosis of post-obstetric fistula closure SUI was made. This was then graded into mild, moderate, and severe

incontinence according to Browning et al[24] Women excluded due to urge incontinence were managed conservatively with oxybutynin tablets, pelvic floor exercises, and bladder training while those with overflow incontinence were treated with intermittent self-catheterization. Those with mild SUI were managed conservatively using pelvic floor exercises.

Surgery

Only participants with moderate and severe post-obstetric fistula closure SUI underwent surgery (urethral plication procedure) after obtaining informed consent and pre-operative preparation. These consequently comprised the cohort analyzed. All surgeries were performed by a team of certified fistula surgeons/ urogynecologists. All surgeries were done under spinal anesthesia. Before surgery with the patient under anesthesia in lithotomy position, the amount of vaginal scarring was assessed and graded into mild, moderate, and severe as described by Goh et al 2005[27] The urethral length and bladder capacity were also measured using a Foley catheter and a metallic catheter respectively as described by Browning and Waaldijk.[23,28] The standard urethral plication procedure as described by Waaldijk, Goh, Thompson and Kelly was performed.[20,26,28–30] With a Foley catheter size 12–16 F in situ, a vertical incision was made in the vaginal mucosa just below the external urethral meatus and extended to the level of the bladder neck. With the help of Allis tissue forceps, the vaginal mucosa was carefully dissected off the urethra and bladder neck laterally into the paraurethral and paravesical space to identify the fascia with maximum care taken to avoid opening into the urethra, bladder, and the previous fistula. Before inserting the plication sutures, a dye test was done to rule out any injury to the urethra, and/ or bladder. Multiple interrupted mattress PDS 0 sutures were inserted laterally in the fascia on either side from top to bottom, pulled across the midline over the urethra and bladder neck, and eventually tied.

For participants who had a short urethra (<2.5 cm), urethral elongation was performed only when there was adequate healthy and mobile vulvovaginal tissue to permit flap advancement without tension. Women with a short urethra who did not have sufficient healthy tissue underwent standard urethral plication without elongation. When performed, urethral elongation involved mobilization of a well-vascularized vulvovaginal mucosal flap adjacent to the labia majora, which was advanced and attached to the urethra with interrupted absorbable sutures. Reinforcing sutures were placed in the surrounding periurethral fascia/tissues to support the reconstruction.

Urethral reconstruction was done for those women with complete urethral loss rather than standard urethral plication alone. This was done by wide mobilization of tissue adjacent to the urethral remnant. The tissue was then folded over a catheter using absorbable suture (vicryl 3/0) with reinforcement of the periurethral tissues to support the repair. The vaginal mucosa over the urethra and bladder neck was repaired using vicryl 2/0 suture. This study therefore evaluated urethral plication with or without concomitant native-tissue reconstructive procedures, as performed in routine fistula surgical practice.

Postoperative Care

Postoperative care was the same for all the participants. All the participants had an indwelling Foley catheter inserted at the end of the surgery. This catheter was removed on the 7th post-operative day. In addition, antibiotics and other elements of postoperative care such as non-opioid analgesia (paracetamol and nonsteroidal anti-inflammatory drugs), fluid administration, and ambulation were prescribed to all the participants which is the routine care protocol at the repair sites. The outcome of surgery (continence Vs Incontinence) prior to discharge was determined one day after removal of the catheter by interviewing the participants and an objective 1-hour pad test performed according to a standardized protocol.[31] A PVR was done to exclude urine retention as a result of obstruction from the procedure.

Data Collection

A data capture tool was used to collect information on the baseline characteristics of the study participants, intraoperative findings, and the post-operative follow-up information. The baseline characteristics included: 1) socio-demographic characteristics (age, marital status, parity, duration with incontinence), 2) pre-obstetric fistula closure history (duration with fistula, mode of delivery preceding fistula development, outcome of the delivery that led to the fistula, number of previous fistula repairs, type of previous fistula if available (circumferential Vs partial), months since last repair). The intra-operative information that was collected included: 1) urethral length, 2) presence or

absence of urethra, 3) bladder capacity in cm, 4) level of vaginal scarring, 5) additional surgeries done (urethral elongation, urethral reconstruction), and 6) intraoperative complications (injury to the bladder, urethra). Post-operative information collected included: 1) outcome on removal of the catheter prior to discharge (continent, incontinent, urine retention). The data capture tool was filled by the operating surgeons or trained study staff. To improve consistency, the data collection tool was reviewed by the study team before use, and the same core variables were collected across all participating sites.

Follow Up of the Participants

After discharge from hospital, the participants were followed up to six months post-surgery to assess for continence status. Participants were contacted through a phone call one week prior to their scheduled visit. The purpose of the call was to remind the participants of their scheduled follow up visit. Participants who could not be reached on phone were traced using the contact of their next of kin. This was to minimize loss to follow-up. During the visit at six months, the participants were assessed for continence or incontinence through history, examination, and pad test. Six-months post-surgery, the surgery was considered successful if the participant was continent all the time and able to void normally. It was considered a failure if the participant was still incontinent.

The SUI at Six-months post-surgery in the participants that were still incontinent was assessed and graded into mild, moderate, severe according to Stamey's incontinence scoring system.[24,32]

Sample Size

The sample size was not determined by a formal power calculation. Instead, it reflected the number of eligible women with moderate or severe post-obstetric fistula closure SUI who were identified, and underwent surgery during the study period. Given the specialized nature of this condition and the camp-based fistula repair model, all eligible participants were included to maximize the available sample.

Statistical Analysis

Data were entered into Redcap and exported to Stata 17 (StataCorp, LLP, College Station, TX, USA) for analysis. Categorical data were presented as frequencies and percentages. The success rate was determined by dividing the number of women who were continent of urine at six-months by total number of women who underwent surgery and completed the follow-up and expressed as a percentage. Changes in the grade of stress urinary incontinence (SUI) between baseline and at six-months post-surgery were assessed using Bowker's test of symmetry and the Stuart–Maxwell test for marginal homogeneity. These tests are appropriate for paired categorical data with more than two levels and evaluate whether the distribution of severity categories (mild, moderate, severe) differed significantly across time points.

To determine the risk factors for failure of the urethral plication procedure, univariable and multivariable analysis were performed using log binomial regression analysis. Risk Ratios (RR) and their corresponding 95% confidence intervals (CI) were reported as the measures of association. Given the modest number of failure events at six months (27), we used a multivariable model to reduce the risk of overfitting. Variables were selected a priori based on clinical relevance, biological plausibility, and previous literature, and included history of repeat fistula repair, urethral length, and level of vaginal scarring. To assess potential confounding by concomitant reconstructive procedures, we performed a sensitivity analysis by adding additional surgery to the model and examined whether the adjusted estimates materially changed. A P value<0.05 was considered statistically significant.

Results

A total of 121 women with post-obstetric fistula closure urethral incontinence were screened. A total of 70 women with post-obstetric fistula closure were enrolled, underwent surgery, and were included in the final analysis. The sample size reflected the number of eligible participants recruited during the study period, and all participants completed the six-month follow-up as shown in Figure 1.

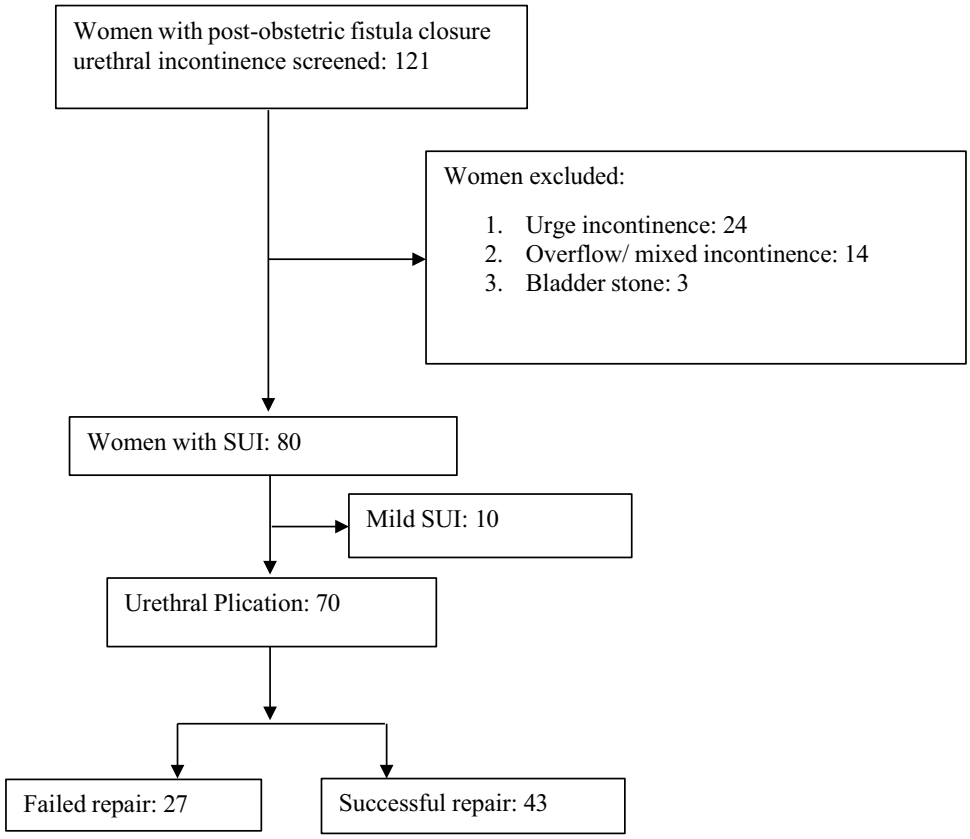


Figure 1 Showing the participant flow diagram.

Sociodemographic and Pre-Obstetric Fistula Closure Characteristics of the Participants

The participants' sociodemographic and pre-fistula closure characteristics are shown Table 1. The mean age of participants was 34 (SD ±12.1) years. More than half were separated (53%, n=37), and most had had a vaginal delivery (56%, n=39) preceding fistula development, and majority 96%, (n=67) had a stillbirth. The majority, had stayed with the fistula for > 1 year (87%, n=61), had urethrovaginal fistula (71%, n=50), the injury was circumferential (59%, n=41), and the repair that closed the fistula was a repeat repair (61%, n=43).

Table 1 Participant Baseline Characteristics

Participant Characteristics	Categories	Total (N=70), n (%)
Age in years (mean±SD)		34.0± 12.1
Age categories (in years)		
	<25	14 (20)
	25-35	24 (34)
	>35	32 (46)
Marital status		
	Married/cohabiting	33 (47)
	Separated	37 (53)
Parity		
	Primiparity (I)	35 (50)
	Multipara (≥II)	35 (50)

(*Continued*)

Table 1 (Continued).

Participant Characteristics	Categories	Total (N=70), n (%)
Mode of delivery preceding fistula development		
	Cesarean	24 (34)
	Vacuum	7 (10)
	Vaginal	39 (56)
Outcome of delivery preceding fistula development		
	Live	3 (4)
	Still birth	67 (96)
Duration of fistula (years)		
	<1	9 (13%)
	≥1	61 (87%)
Type of fistula before closure		
	Bladder neck	20 (29)
	Urethrovaginal	50 (71)
Nature of injury		
	Circumferential	41 (59)
	Partial	24 (34)
	Total urethral loss	5 (7)
Type of fistula repair at closure		
	Primary	27 (39)
	Repeat	43 (61)

Abbreviation: SD, standard deviation.

Peri-Operative Characteristics of the Study Participants

The peri-operative characteristics of the study participants are shown in Table 2. The majority had; severe post-obstetric fistula closure SUI (60%, n=42), mild vaginal scarring (64%, n=45), normal urethral length (59%, n=41), and normal urinary bladder capacity (91%, n=64). Majority of the surgeries lasted for more than 1 hour (76%, n=53), with very few

Table 2 Participants' Peri-Operative Characteristics

Participant Characteristics	Categories	Total (N=70), n (%)
Duration with Post repair SUI (years)		
	<1	36 (51)
	≥1	34 (49)
Grade of Post-obstetric fistula closure repair SUI		
	Moderate	28 (40)
	Severe	42 (60)
Urethral length (cm)		
	Complete urethral loss	5 (7)
	Normal (≥2.5)	41 (59)
	Short (<2.5)	24 (34)
Level of vaginal scarring		
	Mild-Moderate	45 (64)
	Severe	25 (36)
Bladder capacity		
	Normal	64 (91)
	Small	6 (9)

(*Continued*)

Table 2 (Continued).

Participant Characteristics	Categories	Total (N=70), n (%)
Additional surgeries done		
	None	44 (63)
	Yes	26 (37)
Type of additional surgery		
	None	44 (63)
	Urethral elongation	18 (26)
	Urethral reconstruction	8 (11)
Intraoperative complication		
	None	65 (93)
	Bladder injury	2 (3)
	Urethral injury	3 (4)
Duration of surgery (hours)		
	<1	17 (24)
	≥1	53 (76)
Immediate urine retention		
	NA	19 (27)
	No	46 (66)
	Yes	5 (7)

Abbreviations: SUI, Stress Urinary Incontinence; NA, Not applicable (urine retention was not assessed in participants who were incontinent).

intra-operative complications (7%, n=5). In a few of the participants (37%, n=26), additional surgeries were performed on top of the primary surgery (urethral plication), with the most frequently done being urethral elongation (26%, n=18).

Success Rate of the Urethral Plication Procedure

The outcomes of surgery among the study participants are shown in Table 3. Of the 70 participants with post-obstetric fistula closure SUI that underwent urethral plication, 49 were continent at the time of discharge giving a success rate of 70%. However, at Six-months post-surgery, the number of participants that were still continent had dropped by 6 to 43 corresponding to a success

Table 3 Outcomes of Surgery Among the Study Participants at Discharge and at Six-months Post-Surgery

Characteristic	Categories	Total (N=70), n (%)
Outcome at discharge		
	Continent	49 (70)
	Incontinent	21 (30)
Outcome at Six-months post-surgery		
	Continent	43 (61)
	Incontinent	27 (39)
Grade of SUI at baseline		
	Moderate	28 (40)
	Severe	42 (60)
Grade of SUI at Six-months post-surgery (n=27)		
	Mild	15 (56)
	Moderate	8 (30)
	Severe	4 (15)

Abbreviation: SUI, Stress Urinary Incontinence.

Table 4 Risk Factors for Failure of the Urethral Plication Procedure in Management of Post-Obstetric Fistula Repair SUI at Six-months Post-Surgery

Variables	Continent		Unadjusted Analysis		Adjusted Analysis	
	Yes	No	Crude RR	p-value	Adjusted RR	p-value
	N=43	N=27	[95% CI]		[95% CI]	
History of repeat fistula repair						
No	20 (47%)	7 (26%)	1		1	
Yes	23 (53%)	20 (74%)	1.79 [0.88, 3.66]	0.108	1.08 [0.43, 2.72]	0.869
Urethral length						
Complete urethral loss	1 (2%)	4 (15%)	2.73 [1.43, 5.21]	0.002*	3.00 [0.94, 9.62]	0.064
Normal	29 (67%)	12 (44%)	1		1	
Short	13 (30%)	11 (41%)	1.57 [0.82, 2.98]	0.173	1.07 [0.46, 2.51]	0.868
Level of vaginal scarring						
Mild/moderate	36 (84%)	9 (33%)	1		1	
Severe	7 (16%)	18 (67%)	3.60 [1.91, 6.78]	<0.001*	3.77 [1.59, 8.95]	0.003*

Note: *$p < 0.05$.
Abbreviations: RR, Risk Ratio; CI, confidence interval; SUI, Stress Urinary Incontinence.

rate of 61%. On further evaluation of the 27 participants who remained incontinent at Six-months post-surgery, 15 (56%) demonstrated improvement in the grade of incontinence from moderate/severe to mild. Both Bowker's test of symmetry (χ^2 = 20.0, df = 3, p = 0.0002) and the Stuart–Maxwell test (χ^2 = 17.9, df = 2, p = 0.0001) confirmed a statistically significant improvement in incontinence grade following surgery.

Risk Factors for Failure of the Urethral Plication Procedure in Management of Post-Obstetric Fistula Repair SUI

In the unadjusted analysis, complete urethral loss and severe vaginal scarring were significantly associated with failure at six months. After adjusting for history of repeat fistula repair, urethral length, and vaginal scarring, only severe vaginal scarring remained independently associated with failure (aRR=3.77; 95% CI: 1.59–8.95; p=0.003). Complete urethral loss showed a non-significant trend toward increased risk of failure, while history of repeat fistula repair and short urethral length were not independently associated with failure as shown in Table 4.

Sensitivity Analysis Accounting for Concomitant Reconstructive Procedures

A sensitivity analysis was performed by adding concomitant reconstructive surgery to the parsimonious multivariable model. Although additional surgery was associated with failure in the unadjusted analysis (crude RR=1.82; 95% CI: 1.02–3.25; p=0.042), this association was no longer significant after adjustment (adjusted RR=1.08; 95% CI: 0.14–8.61; p=0.940). Severe vaginal scarring remained independently associated with failure (adjusted RR=3.76; 95% CI: 1.57–8.97; p=0.003), suggesting that the main finding was stable after accounting for concomitant reconstructive procedures as shown in Table 5.

Discussion

This multi-center prospective cohort study determined the short-term success rate of the urethral plication procedure in the management of post-obstetric fistula closure SUI at six-months after surgery and risk factors for failure. We found a success rate of 61% at six-months post-surgery dropping from 70% at time of discharge. However, more than half of the women who remained incontinent post urethral plication experienced a significant improvement in severity of incontinence, with 56% shifting from moderate/severe to mild incontinence.

Table 5 Sensitivity Analysis Accounting for Concomitant Reconstructive Procedures

Variables	Continent		Unadjusted Analysis		Adjusted Analysis	
	Yes	No	Crude RR	p-value	Adjusted RR	p-value
	N=43	N=27	[95% CI]		[95% CI]	
History of repeat fistula repair						
No	20 (47%)	7 (26%)	1		1	
Yes	23 (53%)	20 (74%)	1.79 [0.88, 3.66]	0.108	1.08 [0.43, 2.74]	0.863
Additional surgeries done						
None	31 (72%)	13 (48%)	1		1	
Yes	12 (28%)	14 (52%)	1.82 [1.02, 3.25]	0.042*	1.08 [0.13, 8.61]	0.940
Urethral length						
Complete urethral loss	1 (2%)	4 (15%)	2.73 [1.43, 5.21]	0.002*	2.77 [0.25, 30.83]	0.407
Normal	29 (67%)	12 (44%)	1		1	
Short	13 (30%)	11 (41%)	1.57 [0.82, 2.98]	0.173	1.00 [0.13, 7.91]	1.000
Level of vaginal scarring						
Mild/moderate	36 (84%)	9 (33%)	1		1	
Severe	7 (16%)	18 (67%)	3.60 [1.91, 6.78]	<0.001*	3.76 [1.57, 8.97]	0.003*

Note: *$p < 0.05$.
Abbreviations: RR, Risk Ratio; CI, confidence interval; SUI, Stress Urinary Incontinence.

The success rate of 61% in this study is comparable to that reported by Ascher-Walsh et al[16] and Browning et al[24] of 60% and 55–65% respectively although urethral plication was combined with a pubococcygeal sling in the two studies. However, this finding should be interpreted in the context of a heterogeneous cohort in which urethral plication was the primary continence procedure, while 37% of participants required concomitant reconstructive procedures, mainly urethral elongation and urethral reconstruction. Therefore, the reported success rate reflects outcomes of urethral plication as performed in addition to other reconstructive continence procedures rather than urethral plication in isolation.

Among the women who were incontinent at six-months post urethral plication, significant improvement in the severity of SUI was demonstrated, with more than half shifting from moderate/severe to mild incontinence. These findings suggest that urethral plication does not only confer complete continence for a majority, but also reduces symptom burden among the failures, a critical outcome in women for whom residual incontinence is as distressing as a failed fistula closure, and contributes to profound social and psychological effects.[5]

The success rate of urethral plication reduced from 70% at the time of discharge to 61% at six-months. This is similar to what was reported by Andrew Browning et al[24] This could be due to a weakening of the already overstretched Pubo-vesical/cervical fascia with time or migration of this tissue back to its original place on the pubic rami due to viscoelastic creep.[33] The decline in the success rate may raise concerns about longer-term efficacy of this procedure and whether tissue remodeling or progressive scarring undermines continence over time. Consequently, extended follow-up studies are essential to evaluate these longitudinal outcomes.

Compared to other surgical procedures, its effectiveness in this study is comparable to other procedures such as bladder neck suspensions, which report continence rates of 65–80%,[17] and autologous fascial slings with rates of 70–90%.[16] Although Carey et al[16] reported a continence rate of 78%, their technique of combining retropubic urethrolysis, pubovaginal sling, and omental graft is more complex and associated with more complications such as abdominal wound infections, abdominal wall distortion after harvesting the fascial sling, and reopening of the fistula. Comparison of urethral plication with newer methods like urethral bulking agents is difficult due to limited data because urethral bulking agents are costly, require periodic injections, and are not readily available in this setting.[34]

In our study, severe vaginal scarring was found as one of the risk factors for failure. This is in correlation with other studies.[16] Scarring may reduce urethral mobility and keeps the urethra in an open fixed position hence interfering with the closing mechanism which keeps the patient incontinent.[24] Furthermore, in patients with severe vaginal scarring, it is difficult to mobilize sufficient tissue laterally that is needed for plication which increases the risk for failure.[24,33]

The contribution of this study lies in providing prospective multicenter evidence from a low-resource fistula repair setting, with standardized diagnostic evaluation and analysis of anatomical factors that influence short-term continence outcomes.

Strengths and Limitations

Our study has several strengths, including its prospective design, standardized diagnostic work-up using FIGO/obstetric fistula surgery guidelines, a six-months follow-up period, and objective grading of SUI.[24] However, important limitations include: 1) the modest sample size of 70 women, and the limited number of events may still affect precision and reliability of adjusted risk estimates, 2) We used crude cystometry because formal urodynamic studies were unavailable in our setting. While this approach is more operator-dependent and may have introduced measurement error, we sought to reduce this limitation by applying a standardized assessment protocol, using trained clinicians, and interpreting cystometric findings together with the clinical assessment. 3) The reported success rate cannot be attributed to urethral plication alone, but reflects outcomes of urethral plication as used in routine fistula surgical practice, where concormitant reconstructive procedures may be required depending on anatomical findings. 4) The follow-up period was limited to six months; therefore, the findings represent short-term continence outcomes only and should not be interpreted as evidence of long-term effectiveness.

Conclusions

Urethral plication, as performed in routine surgical practice appears to be a safe, simple, and effective surgical option for the short-term management of stress urinary incontinence after obstetric fistula repair. The procedure also improves the severity of incontinence in those that may fail. Severe vaginal scarring was the main independent predictor of failure. In carefully selected patients like those ones with a preserved urethra and minimal vaginal scarring, urethral plication may be considered as a short-term continence procedure for treatment of post obstetric fistula closure SUI. However, a substantial proportion of women with extensive post-fistula tissue loss and complex/ distorted anatomy may require concomitant reconstructive procedures such as urethral elongation or urethral reconstruction. Larger studies involving larger cohorts and longer follow-up periods are needed to fully understand the long-term effectiveness of this procedure.

Abbreviations

BCH, Bwindi Community Hospital; CI, confidence interval; FIGO, International Federation of Gynecology and Obstetrics; LRRH, Lira Regional Referral Hospital; MRRH, Mbarara Regional Referral Hospital; MUST, Mbarara University of Science and Technology; NA, not applicable; PDS, polydioxanone suture; PVR, post-void residual; REC, Research Ethics Committee; RR, risk ratio; SD, standard deviation; SUI, stress urinary incontinence; UI, urinary incontinence; UNCST, Uganda National Council for Science and Technology; and USA, United States of America.

Data Sharing Statement

The datasets for this study are available on request from the corresponding author.

Ethical Considerations

Ethical approvals were obtained from the Mbarara University of Science and Technology (MUST) Research Ethics Committee (REC No. 17/08-18), and the Uganda National Council for Science and Technology (UNCST) number HS368ES. The study was a sub-study of a bigger study on Pelvic floor disorders that received approval from the Ethics committee of Mbarara University of Science and Technology. We respected the guidelines of Helsinki and CIOMS-2002 (Council for International Organizations of Medical Sciences) regarding research with humans, avoiding any type of physical or moral harm. We informed the participants of the study objectives and only those that gave written consent were recruited. Confidentiality was observed during all the interviews and examinations. Participants who were still incontinent after the follow-up period were re-managed accordingly.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

The authors declare that there is no conflict of interest in this work.

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