

Diagnosis and management of ureterovaginal fistula in a resource limited setting: a 12 years' experience at four fistula surgery centers in Uganda

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Abstract

Background: Ureterovaginal fistulae usually follow iatrogenic injury to the ureter during pelvic surgery. This manifests as urine incontinence and results in serious psychosocial effects to the women. Ureterovaginal fistulae unlike vesicovaginal fistulae present challenges in diagnosis and management especially in resource constrained settings.

Objective: To describe the magnitude, aetiology, diagnosis, management and outcomes of ureterovaginal fistula at four fistula surgery centres in Uganda over a twelve-year period.

Methods: A retrospective review of charts for women who had fistula repair at four regional fistula repair centres in Uganda from 2010 to 2021 was conducted. The diagnosis of ureterovaginal fistula was made clinically using a combination of a history of leakage of urine through the vagina following a pelvic surgery, absence of visible anterior vaginal wall defect on speculum examination, a negative methylene blue dye test, and a three-swab test. All women were managed using open transvesical ureteral reimplantation with or without Boari flap. A ureteral stent and Foley catheter were left in situ for 2 weeks. The outcome of surgery (successful fistula repair with urine continence) was determined at 2 months post-surgery. This was confirmed through a vaginal speculum exam.

Results: Overall, there were 477 women who were managed for genito-urinary fistulae during the study period. Approximately 1 in every 10 women with genitourinary fistula had uretero-vaginal fistula (n=47, 9.8%). The mean age of the women with ureterovaginal fistula was 31.9 (SD ±11.8) years. Majority of the ureterovaginal fistulae (n=33, 70.7%) followed caesarean sections done at general hospitals (n=22, 46.8%) by medical officers (n=32, 68.1%). The clinical assessment method used in this study was accurate in diagnosing ureterovaginal fistula. Successful fistula repair with urine continence using the open transvesical ureteral reimplantation was achieved in 45 (95.7%) of the cases.

Conclusion: Iatrogenic ureterovaginal fistulae are common in Uganda and most follow caesarean section performed at lower-level health facilities by medical officers. In resource limited settings where advanced diagnostic techniques aren't available or not affordable, a simple but careful step-wise clinical evaluation described in this study is effective in making a diagnosis. Open transvesical ureteral re-implantation fistula repair technique has a high successful repair rate with urine continence.

Background

A ureterovaginal fistula is an abnormal communication between the ureter and the vagina that often results from unidentified accidental injury to the ureter during pelvic surgery(1). The ureter is susceptible to injury during pelvic surgery because of its close proximity to pelvic structures such as the uterus, cervix, broad ligament and urinary bladder (2). Furthermore, anatomical changes during pregnancy and pelvic pathologies like fibroids, ovarian masses, endometriosis, pelvic inflammatory disease, and adhesions from previous abdominal surgery lead to alteration in the course of the pelvic ureter making it more susceptible to injury especially if the surgeon has limited skills (3). Mechanisms of ureteric injuries

include; contusion, kinking, devascularisation, laceration, suture-ligation, and circumferential transection(4).

Ureterovaginal fistula is one of the sequelae of ureteric injury, the others being ureteric obstruction, loss of kidney function and death(5). Ureterovaginal fistulas often present with urinary incontinence which has a lot of devastating effects on the quality of life of the affected women in form of mental, social, marital and financial repercussions(6) .

In high-income countries, ureteral injury is more common during gynecological surgery than obstetric procedures (7). Open gynecological surgery procedures account for 0.5 to 1.5% of the injuries while laparoscopic surgeries account for 0.5 to 14% (8). However, this seems to be different in the low- and middle-income countries where most of the injuries follow emergency obstetric surgeries with cesarean section accounting for more than 50% of cases while hysterectomy and uterine repair for ruptured uterus account for about 27% (9). Efforts to make cesarean section and other emergency operations more accessible in these countries have been fairly successful but have not been followed with strategies to ensure that the surgeries are safe (10). There are still surgical training challenges coupled with human resource shortages possibly explaining the surgical errors that lead to these injuries (11).

The diagnosis and management of ureterovaginal fistula in low resource settings is a challenge. The standard diagnosis usually involves a combination of history of urine incontinence following a pelvic surgery, dual-dye test, intravenous pyelogram, cystoscopy and CT urogram (12–14). However, these advanced tests are not readily available and not affordable in the low-income countries which calls for the use of low cost but equally sensitive diagnostic methods to make a diagnosis.

The treatment of ureterovaginal fistula has evolved drastically over the past 50 years from open ureteral reimplantation to newer effective and less invasive procedures like endoscopic ureteral stenting (15). However, these newer less invasive techniques are not readily available to women in the low-income countries.

There is paucity of data on the diagnosis, management and outcomes of ureterovaginal fistula yet this evidence is important for advocacy in scaling up the prevention and treatment for this devastating condition in the resource limited settings where women with fistula face various challenges in accessing care (16).

Therefore, in this study, we aimed to describe the aetiology, diagnosis, management and outcomes of ureterovaginal fistula at four rural fistula surgery centres in Uganda.

Methods

Study design and study setting

This was a retrospective chart review of women who had fistula surgery at four rural fistula repair centers in Uganda from 2010 to 2021. The centers included; Mbarara Regional Referral Hospital in Southwestern Uganda, Lira Regional Referral Hospital in Northern Uganda, Kitovu Mission hospital in Central Uganda and Bwindi community Hospital in Western Uganda. The surgical team was led by fistula surgeons from Mbarara University of Science and Technology.

Study population and recruitment

We reviewed all files of women that were managed for genitourinary fistula at the four centers between 2010 and 2021. From these, we identified all those that had a diagnosis of ureterovaginal fistula for data collection.

Diagnosis of ureterovaginal fistula

Ureterovaginal fistula was diagnosed in women who had all the following:

1. Leakage of urine per vagina
2. Any pelvic surgery preceding the urine leakage: cesarean section, uterine repair for ruptured uterus, obstetric hysterectomy, and elective hysterectomy for gynecological conditions.
3. Urine pooling in the vagina with no obvious defect along the entire anterior vaginal wall on speculum examination
4. A negative methylene blue dye test after backfilling the bladder with a minimum of 120 mls of diluted methylene blue
5. A three-swab test (3 cotton swabs placed at different levels in the vagina) after the methylene blue test where none of the swabs was stained with methylene blue but all wet with urine.

The diagnosis of ureterovaginal fistula was then confirmed by intraoperative findings of absence of spillage of urine from the affected ureteral orifice on cystotomy. The standard confirmatory diagnostic tests like intravenous pyelogram, CT pyelogram and cystoscopy were not done because they are neither available nor affordable.

Surgical technique

The women underwent surgical repair of ureterovaginal fistula after obtaining informed consent. All the women had a laparotomy with exploration of the ureteric bed on both sides to identify the affected ureter. The affected side was usually the one where the ureter was dilated. A cystotomy with exploration of the trigone and visualization of the ureteral orifices was done to finally confirm the diagnosis of ureterovaginal fistula and the side affected. This was done after giving the patient an intravenous bolus of 10mg of Frusemide. The affected ureter was the one which wasn't spilling urine through its ureteric orifice.

After identifying the affected ureter, it was mobilized from its peritoneal and broad ligament attachments up to the point of injury. The bladder was also mobilized from its pelvic attachments. This was done to minimize tension during re-implantation. The main procedure that was done was a ureteroneocystostomy

(implantation of the injured ureter into the bladder) with absorbable sutures. In cases where the ureter had been injured at a relatively high level (above the pelvic brim) resulting in significant loss of ureteral length, a Boari flap was performed. In all cases, a ureteric stent was inserted and attached to the Foley catheter. The bladder was then closed in 2 layers with absorbable suture. Both the urethral stent and Foley catheter were removed after 2 weeks. The women stayed in hospital under observation until removal of the Foley catheter. All surgeries were performed by a team of urogynecologists/ fistula surgeons, as part of routine management of genitourinary fistula in these fistula repair centers. The women were discharged and reviewed after two months. The outcome of surgery was determined at 2 months after surgery. This was either successful fistula closure (patient continent of urine at 2 months post-surgery) or unsuccessful fistula closure (patient still leaking urine at 2 months post-surgery). A speculum exam with participant in lithotomy was done to confirm absence or presence of urine leakage.

Data collection

A data capture tool was used to collect information on baseline characteristics of the study participants, perioperative findings and outcome of surgery.

The baseline characteristics included:

1. Sociodemographic characteristics (age, occupation, parity at fistula development and marital status).
2. Clinical characteristics (duration with incontinence, antecedent surgery, level of the health facility where the antecedent surgery was performed, and cadre of the surgeon that performed the antecedent surgery). The level of health facility was classified according to Uganda Ministry of Health system into; Referral hospital including National and Regional (one with specialists like obstetricians), general hospital (no specialists but surgeries are done by a medical doctor with a first degree otherwise called a medical officer), and a health center IV which is the lowest level facility in the Ugandan health system where a caesarean section can be performed by a medical officer. The cadre of surgeon that performed the antecedent surgery was classified into; intern doctor (one who has just completed medical school and undergoing one year of clinical apprenticeship), medical officer (a doctor who has completed internship), resident (a doctor undergoing speciality training in obstetrics and gynecology) and specialist (one who has graduated from residency).

The perioperative information that was collected included:

1. Diagnostic method used (clinical evaluation using history, speculum examination, methylene blue test and 3 swab-test).
2. Ureter affected (Right, left or bilateral)
3. Site of ureteric injury (within the pelvis or above the pelvic brim)
4. Type of surgery performed (ureteral re-implantation alone, ureteral re-implantation with a Boari flap)
5. Complications of surgery (intraoperative hemorrhage that required transfusion and wound infection that required daily dressing)

The outcome of surgery was determined at 2 months after surgery. This was either successful fistula closure (patient continent of urine at 2 months post-surgery) or unsuccessful fistula closure (patient still leaking urine at 2 months post-surgery).

Statistical analysis

Data were cleaned, entered in Excel and exported to Stata version 15 for analysis. Categorical data were presented as frequencies. Descriptive statistics were used to present the data. The proportion of successful fistula repair with continence was determined by dividing the number of women who were continent of urine at 2 months post-surgery by the total number who came for the follow-up visit and expressed as a percentage.

Ethical considerations

Ethical approval

s were obtained from the Mbarara University of Science and Technology (MUST) Research Ethics Committee and the Uganda National Council of Science and Technology number (UNCST) number HS368ES.

Results

Demographic and clinical characteristics of the participants

The demographic and clinical characteristics of the participants are shown in Table 1. A total of 477 genitourinary fistulae were managed during the study period. Of these, 47 (9.9%) had ureterovaginal fistulae, vesicovaginal fistulae (146, 30.6%), vesicocervical fistulae (72, 15.1%), urethrovaginal fistulae (181, 37.9%), and vaginal vault (31, 6.5%). The mean age at diagnosis of the women with ureterovaginal fistula was 31.9 (SD \pm 11.8) years. Majority were of parity $>$ 4 (n = 25, 53.2%, range 1–7) and had been with urine incontinence for more than a year at the time of diagnosis (n = 17, 36.2%). Most fistulae (n = 33, 70.7%) developed after a caesarean section while 9 (19.5%) occurred after a hysterectomy for obstetric indications mainly ruptured uterus. Most of these antecedent surgeries (n = 22, 46.8%) were performed at general hospitals, and by medical officers (n = 32, 68.1%).

Table 1
Demographic and clinical characteristics of the patients

Characteristic	N = 47		
	Description	Frequency, n	Percentage
Age	< 25yrs	10	21.3
	25-35yrs	15	31.9
	> 35years	22	46.8
Occupation	Unemployed	43	91.5
	Employed	4	8.5
Marital status	Single	5	10.6
	Married	36	76.6
	Divorced/separated/widowed	6	12.8
Parity at diagnosis	1	10	21.3
	2-4	12	25.5
	≥ 5	25	53.2
Duration of incontinence	< 3 months	16	34.0
	3 months - 1year	14	29.8
	≥ 1year	17	36.2
Antecedent surgery	Caesarean section	33	70.7
	Obstetric Hysterectomy	9	19.5
	Hysterectomy for gynaecological indications	5	9.8
Level of facility for antecedent surgery	Referral hospital	19	40.4
	General hospital	22	46.8
	Health centre IV	6	12.8
Cadre of surgeon that performed antecedent surgery	Intern doctor	7	14.9
	Medical Officer	32	68.1
	Resident	4	8.5
	Specialist	4	8.5

Perioperative characteristics of the participants

The perioperative characteristics of the patients are shown in Table 2. For all the participants, the step-wise clinical assessment was accurate in diagnosing ureterovaginal fistula. At surgery, the left ureter was the most affected (n = 24, 51.1%). Most injuries to the ureter (n = 45, 95.6%) occurred within the pelvis while in 2 women it occurred above the pelvic brim. The commonest fistula repair surgery done was ureteric reimplantation alone 45(95.7%) while in 2(4.3%) patients, a Boari flap was performed due to a short ureter. The surgical complications encountered included; intraoperative hemorrhage that required blood transfusion in 5 (11%) of the women and post-operative wound infection (n = 5, 11%). The women with wound infection all improved following daily dressing and antibiotic treatment.

Table 2
Perioperative characteristics of the participants (N = 47)

Characteristic	Description	Frequency	Percentage
Affected ureter	Left	24	51.1
	Right	12	25.5
	Bilateral	11	23.4
Level of injury	Above pelvic brim	2	4.3
	Below pelvic brim	45	95.7
Surgery performed	Ureteric re-implantation alone	45	95.7
	Ureteric re-implantation with Boari flap	2	4.3
*Surgical complications	No complication	40	85.1
	Intra-operative hemorrhage	5	11.0
	Wound infection	5	11.0
Note: * The number of complications exceeds the number of patients because 3 patients had more than one complication.			

Outcomes of surgery

Out of the 47 women managed for ureterovaginal fistula, 45 (95.7%) had successful closure of the fistula with continence. This is shown in Fig. 1.

Discussion

This study set out to describe the magnitude, etiology, diagnosis and management of iatrogenic ureterovaginal fistula in a resource limited setting. We found that ureterovaginal fistula is common, occurring in 1 in 10 women with genitourinary fistula. Ureterovaginal fistula commonly followed obstetric operations especially cesarean section performed by lower cadre surgeons (medical officers). A simple step-wise clinical evaluation combined with intraoperative findings is effective in diagnosing

ureterovaginal fistula and locating the affected side. The success rate of open transvesical ureteral reimplantation in this setting is 95.7%.

The magnitude of 10% is similar to that found by Shaw and colleagues in a study done at 3 Cleveland clinics in the United states of America (17). However, this proportion is higher than the 4.6% (273/5,959) found in a review done in 11 African countries by Raassen and colleagues (18). As reported in this review, iatrogenic ureterovaginal fistulas were likely to occur in surgeries done by lower cadres especially medical officers. This is not surprising because medical officers are usually recent graduates of medicine with very little surgical experience who get posted to general hospitals and health center IVs to work independently. Since most of the emergency obstetric surgeries especially Cesarean section in Uganda are done by medical officers (19), it explains the high proportion of iatrogenic ureterovaginal fistula in this study. Further to this, the cesarean delivery rates in Uganda have increased from 8.5% in 2012 to 11% in 2016 (20) but these haven't been matched by improvement in human resource to provide safe cesarean section. Surgical training challenges coupled with human resource shortages still exist possibly explaining the surgical errors that lead to these injuries(11) (21) .

In agreement with previous studies in the low income countries, most of the ureterovaginal fistulae in our study followed injuries sustained during obstetric surgeries particularly cesarean section (2, 9) as opposed to studies done in high income countries where majority are due to gynecological surgeries (7, 22, 23). Like in other low income countries, obstructed labour and repeat caesarean section are the commonest indications for cesarean section in Uganda (24, 25). In prolonged obstructed labour, the fetal head gets deeply impacted in the maternal pelvis and lateral extension of a low transverse uterine incision may occur during delivery resulting into excessive hemorrhage. Ureteric injury in this case usually results from desperate attempts to achieve hemostasis without proper identification of the ureter (26, 27). Scar tissue and adhesions from prior cesarean section may distort the pelvic anatomy and alter the course of the ureter making it more likely to be injured in repeat cesarean sections (18, 28).

The left ureter was affected more compared to the right, as has been found in several other studies (2, 18, 29). This is because the left ureter is slightly nearer to the cervix compared to the right and is also obscured by the sigmoid mesocolon (18, 30).

In this study, the diagnosis of ureterovaginal fistula was accurately made from a simple clinical evaluation which involved a combination of: history of urine incontinence following a pelvic surgery, absence of visible defect on speculum examination, negative methylene blue dye test, and 3-swab test. A similar method was used in a rural hospital with limited resources in Nigeria (31). This is in contrast to complex and expensive methods used in the high-income countries that involve the use of dual-dye test, intravenous pyelogram, cystoscopy and CT urogram on top of the clinical evaluation (13, 14, 27). However, these investigative techniques are neither available nor affordable in the low-income countries (31). This therefore justifies the need to employ simple and cheap methods that are equally sensitive in diagnosing ureterovaginal fistula in the resource limited countries. In contrast to Randawa et al, we did not do an abdominal ultrasound to evaluate the ureter and kidneys for hydroureter and or hydronephrosis

in order to determine the affected side (31). This is because the ultrasound may be misleading since absence of hydronephrosis does not necessarily imply that the particular side is not affected especially if the leakage from the injured ureter occurred immediately after the obstruction or if the ureter was just transected (32). We therefore identified the affected side intraoperatively by opening the bladder and visualizing the ureteric orifices for urine spillage.

Our surgical technique of laparotomy with ureteroneocystostomy/ ureteral reimplantation was effective in achieving continence. This is not different from findings in other similar studies (2, 3, 33), implying that this method can effectively be used in the repair of ureterovaginal fistulae in properly selected patients especially in distal ureteral injuries. In more proximal injuries where the ureteral length is inadequate, a Boari flap can be used to ease tension on the anastomosis between ureter and bladder (34). However, newer and less invasive techniques of managing ureterovaginal fistula employed in the high-income countries like endoscopic ureteral stenting were not used in this study. This is because these methods are not readily available and surgeons with skills to perform them are limited.

Conclusions

Iatrogenic uretero-vaginal fistulae are common in our setting being detected in 1 in 10 women with genitourinary fistula and most follow caesarean section done at lower health facilities by medical officers. Simple but careful step-wise clinical evaluation is effective in diagnosing ureterovaginal fistula where other investigative techniques aren't available. Open transvesical ureteral reimplantation is highly effective in treating ureterovaginal fistula in resource limited settings where use of newer less invasive procedures may not be possible. We also recommend that medical doctors conducting caesarean section and other pelvic surgeries should receive regular training in essential surgical skills to reduce on the burden of this devastating condition.

Abbreviations

CT: Computed tomography

MRRH: Mbarara Regional Referral Hospital

MUST: Mbarara University of Science and Technology

UNCST: Uganda National Council of Science and Technology

UNFPA: United Nations Fund for Population Activities

Declarations

Ethical approval and consent to participate: ethical approvals were obtained from the Mbarara University of science and Technology (MUST) Research Ethics committee and the Uganda National Council of

Science and Technology (UNCST) number HS368ES. Written consent was obtained from all the patients prior to surgery. All the experiment protocol for involving humans was in accordance to guidelines of national/ international/ institutional or declaration of Helsinki.

Consent to publication: Not applicable

Availability of data and materials: The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests: The authors declare that they have no competing interests.

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Author's contribution: RK and KM conceived the idea, supervised data collection and wrote the first draft. VG, LT, OB PK, BA, TM, PK, HL, JN and LHM participated in data analysis and interpretation. All authors read, revised and approved the final draft of the manuscript.

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Figures

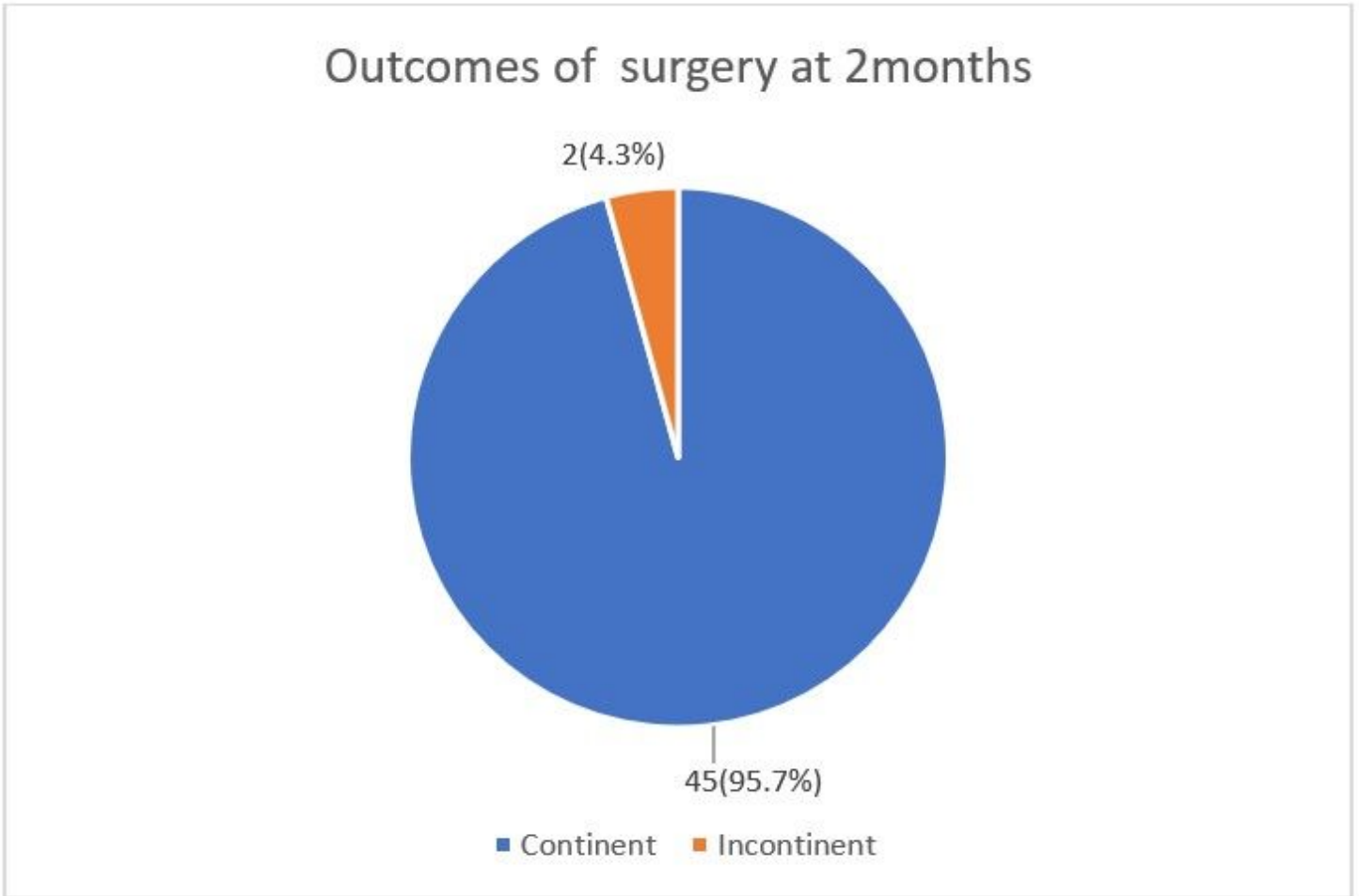


Figure 1

Outcomes of surgery