

ORIGINAL RESEARCH

Urethral catheterization–associated urethral strictures in men at a tertiary hospital in Kigali, Rwanda: A cross-sectional study

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Abstract

Background

Urethral catheterization is a risk factor for urethral stricture formation. Urethral strictures impact quality of life and increase medical expenses. We aimed to determine factors associated with catheter-induced urethral strictures among males treated at a university teaching hospital in Kigali, Rwanda.

Methods

We retrospectively reviewed the medical records of male patients whose urethral strictures were managed at a tertiary referral hospital in Kigali over a 1-year period. Follow-up data were collected for those found to have developed urethral catheterization–associated strictures.

Results

In 2016, 118 patients with urethral strictures consulted our hospital: 26 strictures (22.0%) were catheter induced, and 13 patients (mean age, 46 years; all male) provided follow-up data via questionnaire-guided interviews. The median symptom duration before consultation was 105 days (interquartile range [IQR], 12–544 days). The main reason of delayed presentation was delayed transfer from the district hospital (53.8%). Many patients (38.5%) attributed stricture development to trauma during catheterization, although most (76.9%) were unconscious during catheterization. Most catheterizations were done at referral hospitals (53.8% vs 38.5% done at district hospitals), and 46.2% were done in the emergency department. The main indication for catheterization was unconsciousness (53.8%), followed by monitoring of urine output (30.8%). The median duration of catheterization was 10 days (IQR, 7–23 days), and the median time between catheterization and onset of symptoms was 1 month (IQR, 3 weeks to 16 months).

Conclusions

Although preventable, catheter-induced urethral strictures continue to be burdensome. Healthcare professionals should avoid unnecessary catheterization. To avoid long-term complications, it is imperative to perform catheterization safely for those who require the procedure.

Keywords: urethral catheterization, urethral strictures, trauma, Rwanda

Introduction

A urethral stricture is a narrowing of urethra, which results in voiding difficulties and impaired quality of life. The prevalence of urethral strictures among men in high-income countries is about 0.9%.^[1] Periurethral fibrosis is the implicated pathogenetic mechanism regardless of the cause of stricture formation. Typical symptoms of urethral

strictures include dysuria and urinary retention. Retention of urine may lead to urinary tract changes and high-pressure reflux, which can impair kidney function.^[2] The diagnostic criteria for urethral strictures are controversial, but it is clear that the condition consists of narrowing of the urethra at any point from the bladder to the tip of the penis. Clinical examination and imaging studies help confirm the diagnosis.

One of the common causes of urethral stricture formation is injury to the urethra from inappropriate or prolonged catheterization. Other causes of urethral strictures include sexually transmitted infections, urethral injuries from pelvic fractures or straddle injuries, and urogenital surgical procedures. Infectious causes are becoming less common in high-income countries relative to traumatic and iatrogenic causes.[1],[3] Historically, gonococcal urethritis was a common cause of urethral stricture formation; However, with early treatment of infection, this has become less common. Currently, external trauma, the use of various endoscopic instruments, and indwelling catheter placement, have become the more common causes of urethral stricture formation. Urethral dilation, urethrotomy, and urethroplasty are possible treatment options.[4] Management of urethral strictures in low-resource settings can be particularly challenging due to a lack of urologists, limited resources, limited operating theatre space, and financial constraints.[4]

Untreated or inadequately treated urethral strictures are associated with many complications, including life-threatening conditions, such as Fournier's gangrene, renal failure, bladder dysfunction, and urethral carcinoma. Urethral catheterization use is common for patients who are being prepared for surgery, as well as for patients with impaired consciousness and those who are bedridden for any reason. The burden of urethral strictures is significant in terms of patient quality of life and financial strain.

This study aimed to determine factors associated with catheter-induced urethral strictures among patients managed at a tertiary referral hospital in Rwanda, the circumstances around urethral catheterization, and the mean interval to stricture development after catheterization.

Methods

This was a descriptive study conducted at the Urology Unit of the Department of Surgery at the University Teaching Hospital of Kigali (Centre Hospitalier Universitaire de Kigali, CHUK). CHUK is a 560-bed hospital with about 25% of beds dedicated to surgical patients. It has 6 operating theatres. Urologists operate 3 days in a week and manage 5 clinics per week. As 1 of 3 tertiary referral hospitals staffed with urologists, CHUK receives patients referred from all provinces in Rwanda. Most patients are referred to CHUK from district hospitals, so it is a strategic place to investigate the scope of urologic disease in the country. When patients arrive at the hospital, they are received by a receptionist nurse who reviews the referral note to identify the reason of transfer. An appointment is then scheduled accordingly.

Eligible patients were those who presented to the CHUK Urology Unit's outpatient clinic over a 1-year period (January through December 2016) with a diagnosis of urethral stricture. Most urethral stricture diagnoses were made clinically. Investigations were conducted for confirmation, localization, or to determine the underlying causes of strictures. The target population comprised patients whose urethral stricture diagnoses were secondary to urethral catheterization as confirmed by outpatient consultations. Catheter-induced

Table 1. Urethral stricture lengths among patients treated for catheterization-associated strictures at the University Teaching Hospital of Kigali urology outpatient clinic, January-December 2016 (N=13)

| Length | n (%) |
|--------|--------|
| <2 cm | 7 (54) |
| 2-4 cm | 4 (31) |
| 4 cm | 2 (15) |

Table 2. Causes of urethral strictures managed at the University Teaching Hospital of Kigali urology outpatient clinic, January-December 2016 (N=118)

| Cause | n (%) |
|--------------------------------|-----------|
| Trauma | 38 (32.2) |
| Sexually transmitted infection | 19 (16.1) |
| Urethral catheterization | 26 (22.0) |
| Other | 35 (29.7) |

urethral strictures were defined according to urologists' assessments based on clinical features and investigational findings. We excluded patients whose urethral strictures were not caused by catheterization. We also excluded patients who had previously been diagnosed with urethral strictures before catheterization.

Data were collected from patient files. Eligible patients were called for study-specific follow-up interviews, and a questionnaire was used to collect data that were missing from the files. Analysed variables included age, residence, symptoms at consultation, duration of symptoms, reason for delayed presentation, indication for catheterization, loss of consciousness during catheterization, pain during catheterization, place of catheterization, duration of catheterization, management, and current status.

Data were entered into an Excel (Microsoft Corp., Redmond, WA, USA) database and analysed using SPSS Statistics for Windows, version 26 (IBM Corp., Armonk, NY, USA). Descriptive statistics were compiled and calculated, with frequencies and percentages used to summarize categorical variables, and medians and interquartile ranges (IQRs) were used to summarize continuous data.

The CHUK Ethics Committee granted ethical approval, and all patients who were contacted to participate provided informed consent.

Results

In 2016, 118 patients presented to the CHUK urology outpatient clinic with urethral strictures. Among these, 26 patients (22.0%) had catheter-induced strictures (Table 2). Thirteen patients with catheterization-induced strictures were identified for follow-up and enrolled in the study.

All 13 patients were male. The mean age was 46 years (range, 13-87 years), and most (n=12, 92.3%) were referred

Table 3. Predisposing factors associated with urethral stricture development, as reported by patients treated for catheterization-associated strictures at the University Teaching Hospital of Kigali urology outpatient clinic, January-December 2016 (N=13)

| Factor | n (%) |
|--------------------------------------|----------|
| Trauma during catheterization | 5 (38.5) |
| Prolonged indwelling catheterization | 3 (23.1) |
| Other | 3 (23.1) |
| None | 2 (15.4) |

from a district hospital. Most of the patients (n=8, 61.5%) had complete urinary retention at the first consultation at CHUK, and the remainder had difficulty passing urine. The median duration of symptoms before urological consultation was 105 days (IQR, 12-544 days). Most patients (n=7, 53.8%) reported delayed transfer by the district hospitals as the reason for late consultation.

Five patients (38.5%) mainly attributed their symptoms to trauma during catheterization (Table 3). Another explanation of symptom origin was prolonged catheterization (n=3, 23.1%). Most patients (n=10, 76.9%) were unconscious at the time of catheterization because of an underlying medical condition. Of the 3 patients who were awake during the procedure, 2 reported severe pain during catheterization. Five patients (38.5%) reported experiencing urethrorrhagia during or after catheterization. Most catheterizations (n=7, 53.8%) were performed at the referral hospital. There were 5 (38.5%) performed at district hospitals and 1 (7.7%) at a health centre. The median duration of catheterization was 10 days (IQR, 7-23 days). The median interval between catheterization and onset of symptoms was 1 month (range, 1 week to 4 years; IQR, 3 weeks to 16 months).

A range of treatment modalities were employed (Table 4). Five patients (38.5%) underwent suprapubic catheterization, 3 (23.1%) underwent urethroplasty, 2 (15.4%) underwent urethral dilation, and 3 (23.1%) underwent direct visual internal urethrotomy. At the time of study enrolment, 6 patients (46.2%) were voiding well, and 4 (30.8%) were awaiting surgery (Figure 4). Three patients (23.1%) initially treated by direct visual internal urethrotomy had symptomatic recurrence.

Discussion

In this study, catheter-induced strictures were identified in 22.0% of urethral strictures. This was a similar rate to that reported from both high- and low-resource settings. In a study conducted in the United States, most strictures were idiopathic (65 of 194, 34%) or iatrogenic (63 of 194, 32%), with prolonged catheterization (n=26) a common cause of iatrogenic stricture formation.[5] A study conducted in Italy found that iatrogenic causes were responsible for 556 urethral strictures (38.6%), with 234 (16.3%) attributed to catheterization.[6] In Belgium, iatrogenic causes (transurethral resection, urethral catheterization, cystoscopy, prostatecto-

Table 4. Treatment measures implemented for patients who presented with urethral catheterization-associated strictures at the University Teaching Hospital of Kigali urology outpatient clinic, January-December 2016 (N=13)

| Treatment | n (%) |
|----------------------------|----------|
| Suprapubic catheterization | 5 (38.5) |
| Internal urethrotomy | 3 (23.1) |
| Urethroplasty | 3 (23.1) |
| Urethral dilation | 2 (15.4) |

my, brachytherapy, and hypospadias surgery) were responsible for 45.5% of the identified urethral strictures.[7] Over an 8-year period in Lagos, Nigeria, investigators identified 84 patients who presented with urethral strictures,[8] among which 20.5% were due to iatrogenic trauma, with indwelling catheters responsible for 76.5% the iatrogenic trauma cases.[8] A similar study conducted in India found that 15.2% of urethral strictures developed after catheterization.[9] Another single-centre study conducted in South Africa determined that iatrogenic injuries accounted for 26% of all the urethral strictures.[10] In another study in Kenya, catheter-induced strictures accounted for 28% of urethral strictures.[11] In a study conducted in Senegal, 8.2% of urethral strictures were caused by iatrogenic injury.[12] Over time, the percentage of urethral strictures due to iatrogenic causes is increasing in many places; for example, the proportion of iatrogenic strictures increased from 10.0% in 1991 to 36.8% in 2007 among males attending a stricture clinic at a tertiary hospital in South Africa.[13]

Multiple factors contribute to iatrogenic urethral injuries. Common mechanisms of catheter-induced urethral injuries include intraurethral balloon inflation or the creation of a false passage with the catheter.[14] In our setting, urethral catheterization may not be done properly due to a lack of knowledge or lack of appropriate materials. In this study, 2 of 3 patients who were awake when undergoing catheterization reported severe pain, and 38.5% reported urethrorrhagia during or after catheterization. Inadequate lubrication and prolonged catheterization are other common (and preventable) mechanisms of urethral trauma. In our setting, standard lubricants are seldom available in the emergency department. Instead, normal saline or glycerine may be used during urethral catheterization, and this may be among the major shortcomings that lead to stricture-inducing urethral trauma. Operator-related factors are also important. In a prospective study on iatrogenic urethral injuries at 2 university hospitals, the majority of injuries were caused by senior house officers and occurred out of hours in high-volume, rapid-turnover environments, such as the emergency department.[14] In a separate study, all catheter-related injuries occurred during attempted catheter placement by hospital nursing staff.[15] Education has been highlighted as an important contributing factor; however, our study did not identify the level of training of the health professionals who performed catheterizations. A nursing

education programme was shown to effect a 5-fold reduction in the rate of catheter-related urethral injuries.[15] Future emergency department surveys to investigate the rates of inappropriate catheter placement, inadequate lubrication during catheterization, and intraurethral ballooning are warranted, with the aim of advocating for informational and educational undertakings for healthcare workers, as well as improved availability of proper lubricants in the emergency department. Although knowledge and attitudes towards urethral catheterization among healthcare professionals were beyond the scope of this study, our findings encourage the development and implementation of clear policies and guidelines on urethral catheterization at each health facility, as well as the administration of regular in-service training using simulation labs.

Overall, 62.5% of our patients presented after having urinary retention, with a median of 105 days between symptom onset and presentation at our facility, which was a similar interval to those reported from other low-resource settings. A study in Senegal found that most patients with urethra strictures presented with complications, such as urinary retention or gangrene of the genitalia or perineum; the mean time from symptom onset to urologic consultation was 20 months.[12] The high complication rate seen in the Senegalese patients was attributed to long delays before healthcare consultations, scarcity of healthcare facilities to treat urologic diseases, and a lack of health insurance.[12] All patients included in a study conducted in Nigeria presented with lower urinary tract symptoms, and most (86.9%) presented with complications [16]; the mean symptom duration before presentation to a urologist was over 3 years. Factors contributing to treatment delays in Nigeria included patients lacking funds to pay for treatment, delayed investigations, a healthcare worker strike, and limited operating theatre space.[16]

The challenges in urethral stricture management in resource-constrained settings include limited operating theatre space and few urologists, which may delay definitive management. Complications can arise as patients wait for urethroplasty. In a study conducted in Canada, the median wait time for urethroplasty was 151 days.[17] In our study, the median wait time for urological consultation was 105 days (IQR, 12-544 days), predisposing our patients to many complications while waiting for their strictures to be treated.

Limitations

This study had several limitations. There were some missing data. To overcome this, we captured the missing information by contacting patients by phone. Additionally, the sample size was small, and this study only included patients who presented to the urology clinic. There may have been many patients who were not referred from the district hospital who could not arrange transport or finances to travel to the referral hospital, or who did not have insurance. This study was conducted at a single tertiary referral hospital in Kigali, and therefore it may not be representative of the entire country. However, as CHUK is a referral hospital with a large catchment area, we believe that our findings are reasonably generalizable.

Conclusions

Although preventable, catheter-induced urethral strictures continue to be burdensome. Healthcare professionals should avoid unnecessary catheterization. To prevent urethral strictures and avoid or mitigate long-term complications, it is imperative to raise awareness among health professionals and advocate for improved availability of adequate equipment to ensure safe and appropriate catheterization.

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