

ORIGINAL ARTICLE

Management of Catheter-Associated Urethral Strictures

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ABSTRACT

Background: Urethral stricture is an abnormal narrowing or loss of distensibility of any segment of the urethra surrounded by corpus spongiosum. In the last two decades, there has been a change in the pattern of aetiology of urethral stricture in urban centres in Nigeria with a shift away from post-infective strictures to the emergence of traumatic and iatrogenic causes.

Objective: This study aims to present our observation of the occurrence of long-segment urethral strictures in patients after urethral catheter placement for various indications.

Methodology: This is a descriptive, cross sectional report of patients who presented to and were managed at the Urology Unit of a tertiary hospital in North-Western Nigeria. Relevant information were retrieved from patients' case notes and the data was entered into a proforma and analysed using the SPSS 20 software.

Results: The mean age of the patients was 45.4 ± 19.4 years, with a range of 11-80 years. Indications for urethral catheterization were acute urine retention 11 (43.8%), intra-operative urine output monitoring 9 (28.1%), following road traffic accident 10(31.2%), unconsciousness secondary to meningitis 1 (3.1%) and after urologic surgery 1 (3.1%). Urethral catheterization was carried out in peripheral hospitals in 19 (56.3%) patients; and from the hospitals operating room in 10 (31.2%), accident and emergency room 2 (6.3%) and trauma centre 1 (3.1%). Strictures were panurethral in 22 (68.75%), in the bulbar urethra in 6 (18.75%) and in the penile urethra 4 (12.5%). The length of strictures ranged from 1 cm to 20 cm. Treatments offered included substitution urethroplasty using oral mucosa grafts (OMG) urethroplasty 30 (93.8%), fasciocutaneous penile flap 1 (3.1%) and direct visual internal urethrotomy (DVIU)1 (3.1%). Satisfactory voiding was recorded in 28 (87.5%), voiding was unsatisfactory in 2 (6.3%), while one patient had stricture recurrence and another one is awaiting second stage repair.

Conclusion: Urethral catheterization is an emerging cause of panurethral strictures in our practice and may occur even after relief of acute urine retention but more worrisome following short-term catheterization during surgery. There is need for evaluation of the quality of silicone-coated latex urethral catheters currently available.

Keywords: urethral catheter, catheterization, complications, iatrogenic urethral strictures, Latex allergy

INTRODUCTION

Urethral stricture refers to the abnormal narrowing or loss of distensibility of any segment of the urethra surrounded by corpus spongiosum.^{1,2} The aetiology of this disease has varied from time to time and from region to region. Inflammatory strictures such as those resulting from untreated or poorly treated gonococcal urethritis still predominate in the rural areas of the developing world due to ignorance and poor access to health services.^{3,4,5}

However, in the last two decades, there has been a changing pattern of aetiology of urethral stricture in urban centres in Nigeria with a shift away from post-infective strictures to the predominance of traumatic and iatrogenic causes as has been similarly reported from studies in the southern parts of Nigeria.^{6,7} These iatrogenic strictures result from urethral manipulation following indwelling urethral catheterization, transurethral resection of the prostate, hypospadias surgery, radical prostatectomy and brachytherapy carried out as part treatment for prostate cancer.^{8,9,10}

Placement of urethral catheters is a common procedure that is carried out by various cadres of health workers for a variety of therapeutic, diagnostic indications; in the emergency room, medical wards and in the operation rooms.¹¹ Several complications have been documented worldwide with this apparently simple and routine procedure including urinary tract infection, catheter encrustation, retention and fracture as well as the development of urethral stricture.^{12,13,14,15,16,17}

Since its introduction into clinical practice, urethral catheter make and design have undergone changes and modifications from rubber, latex, polyvinyl chloride (PVC),

plastic, polytetrafluoroethylene (PTFE), siliconized latex, pure silicone and the recent antimicrobial-coated brands. All these changes continue to reflect the physicians' desire for smooth passage, improved drainage and minimized patient discomfort thus reducing post-insertion complications.^{18,19} Despite the above measures, urethral catheters are foreign bodies within the urinary tract and thus elicit some measure of response whose degree depends on tissue bio-compatibility of the catheter material.

The pathogenesis of strictures following urethral catheterization occur by a variety of mechanisms including urethral trauma/mucosal injury due to inadequate lubrication, faulty insertion, urethral ischaemia, hyperinflation of the balloon before full entry into the urinary bladder and these may result in urethral injury, rupture and subsequent stricture formation.^{20,21,22,23}

We present our experience in the management of a cohort of patients who presented or were referred to our practice with urethral strictures following urethral catheterization.

METHODOLOGY

This is a retrospective study of patients who either presented at or were referred to the Urology Unit of a tertiary hospital in North-Western Nigeria, between April 2011 and January 2016 who had developed stricture following urethral catheterization. Ethical approval was sought for and obtained from the Hospital Research and Ethics Committee for the study.

Inclusion criteria were male patients who presented to or were referred to our practice with diagnosis of urethral stricture following

urethral catheterization who had had normal voiding prior to the procedure. However, patients who developed urethral strictures from other causes such as poorly treated urethritis, perineal trauma or of unknown aetiology were excluded from the study.

Some of the patients who presented at the accident and emergency(A/E) came with acute urine retention and were catheterized for relief of the urinary obstruction while some had passage of the catheter as part of the routine monitoring of the acutely injured patient

The diagnosis of stricture was made by clinical presentation of difficulty in passing urine in patients, failed urethral catheterization, no such prior symptoms and the only demonstrable aetiology was a history of previous urethral catheterization. The stricture was confirmed by retrograde urethrogram.

Case notes of the patients were retrieved and the relevant information entered into a proforma and data analysis was with IBM SPSS version 20.0 software. The results obtained were expressed as means and percentages.

RESULTS

There were thirty-two (32) male patients. The mean age of the patients was 45.4 ± 19.4 years with a range of 11-80 years. The most common indications for urethral catheterization were for relief of acute urine retention (AUR) for bladder outlet obstruction (BOO) 11 (43.8%) and intra-operative monitoring during anaesthesia for non-urolgic surgeries 9 (28.1%). Others are as shown in Table 1.

The departments where urethral catheterization was carried out were in the operating room 10 (31.2%), accident and emergency room 2 (6.3%), Trauma centre 1

(3.1%) and from the peripheral hospitals 19 (56.3%), see Figure 1.

The length of the strictures ranged between 1 and 20 cm and were located in the penile urethra in 4 (12.5%) patients, peno-bulbar in 22 (68.75%) and the bulbar urethra in 6 (18.75%).

Surgical treatment offered to the patients include direct visual internal urethrotomy (DVIU) 1 (3.1%), penile fasciocutaneous flaps 1 (3.1%) and oral mucosa graft urethroplasty 30 (93.8%).

Twenty -eight patients (87.5%)had a satisfactory urethral voiding while in 2(6.3) patients, voiding was unsatisfactory. One person has stricture recurrence while another one is awaiting second stage urethral reconstruction

The pre-operative and post-operative micturating cystourethrogram and retrograde urethrogram of two index patients are shown in Figures 3 and 4,

Figure 1. Pie Chart showing the Place of Urethral catheterization

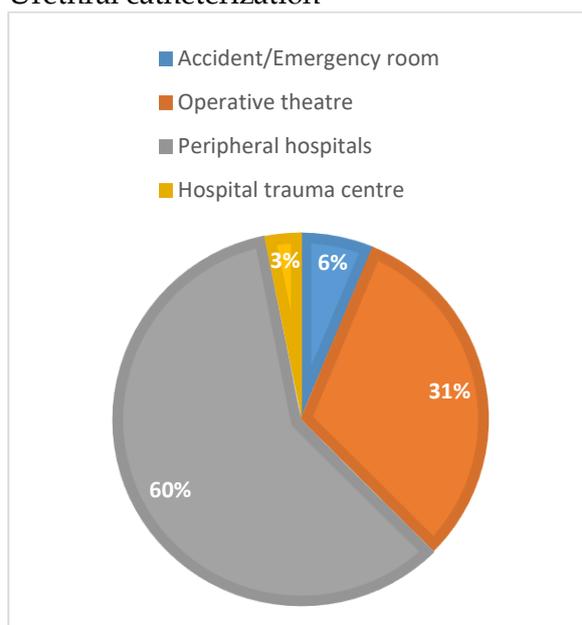


Table 1. Indications for urethral catheterization

Indication	Freq(%)
Acute urine retention	11 (43.8)
Intra-operative monitoring	9 (28.1%)
Road traffic crash	10 (31.3%)
Unconsciousness (Meningitis)	1 (3.1%)
After urologic surgery	1 (3.1%)

Figure 2. Oral mucosa graft donor site

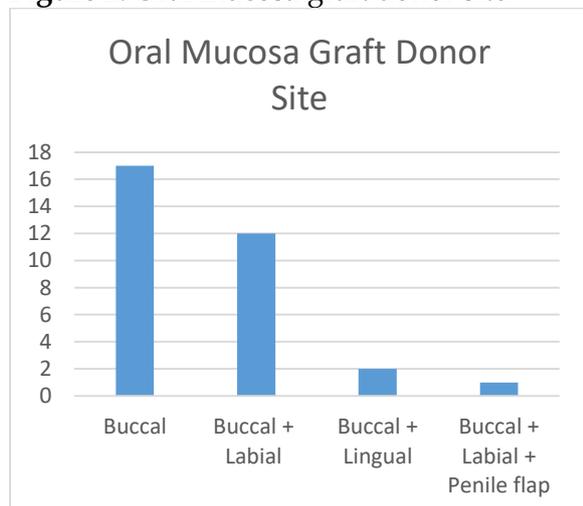
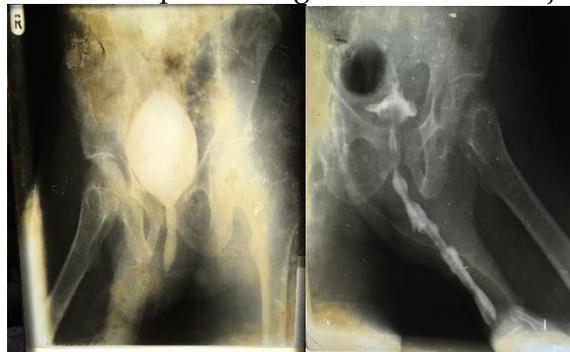


Figure 3. Pre- and post-operative images of a 75-year-old businessman with bulbar stricture after catheterisation during Total Knee replacement surgery



Figure 4. Pre and post-operative(peri-catheter)

image of 43-year-old business man who developed complete panurethral stricture after urethral catheterization at the trauma centre for a penetrating stab abdominal injury



DISCUSSION

Subjects involved in this study included young male children as well as very elderly men as indicated by the wide age range of 11 to 80 years. This is due to the fact that male patients of all ages may undergo urethral catheterization for varied indications and this procedure may be complicated by urethral strictures. Indications for urethral catheter placement were mainly for the relief of acute urine retention (AUR) in patients with enlarged prostate, after trauma of road traffic accident and as part of the routine intraoperative monitoring of the anaesthetized patient in the operative room theatre as has been similarly reported by Davis NF *et al.*²¹

The size of the catheter may be the initiator of the stricture process. However, there was no documentation in the case notes and referral letters of the catheter sizes used in the affected subjects. It has also been reported that large-bore catheters in addition to mucosal injury may also cause retention of urethral secretion which may become secondarily infected and thus result in stricture.²⁴

Occurrence of strictures following urethral catheterization at the peripheral hospitals, the Accident and Emergency (A/E) unit as well as in the Trauma Centre of our hospital may reflect the level of knowledge and experience of the staff who man these facilities as most of these are usually of lower cadre, less experienced medical staff who might not have been adequately trained on the proper technique of urethral catheterization. Reports have shown a relationship between poor training and iatrogenic urethral injuries from faulty urethral catheterization.^{25,26,27} In our institution, the Trauma Centre and the A/ E are separate units manned by different cadres of non-specialist medical staff.

However, occurrence of strictures after urethral catheterization in the operating room by trained surgical staff and residents is worrisome as these occurrences cannot be attributed to lack of knowledge, training or experience of these staff as earlier mentioned. The probable pathogenetic mechanism of these strictures that occurred after catheterization by trained medical staff may be due to poor quality silicone-coated latex catheters with the probability of latex allergic urethral mucosa reaction.

In addition, quite a reasonable number of the patients developed urethral stricture after short-term catheterization in the operative room which was carried out as part of intra-operative patient monitoring. This is similar to the report of Edwards *et al.* in which patients who had urethral catheter placement as part of the routine patient monitoring during anaesthesia for major cardiac surgeries developed strictures.²⁸

The location of the strictures in these patients reflects some of the probable pathogenetic mechanisms of catheter-associated strictures. Strictures in the bulbar urethra especially

towards the penoscrotal angle may be due to trauma and mucosal damage by friction from improperly lubricated catheter and this is similar to a report on iatrogenic urethral strictures.²⁹ In this study, most of the strictures were of long segment and involved the penile and bulbar urethra (panurethral strictures). A panurethral stricture is defined as spongiofibrosis involving both the bulbar and penile urethra and this term is often used interchangeably with long-segment urethral strictures as reported by Martins *et al.* and Kulkarni *et al.*^{30,31} This extensive affectation of the urethra in these patients cannot be explained as merely a result of localized urethral mucosal injury or trauma.

These extensive strictures most probably resulted from urethral mucosal reaction to the presence of the catheters which are foreign bodies. The commonly available type of urethral catheters in our practice are made from latex with coating of silicone. Latex sensitization and allergy are not uncommon phenomenon worldwide among health workers and the general population; and the possible occurrence in the study subjects may be probable.³² The coating with silicone may not be sufficient to prevent the body recognition of this foreign protein and this may elicit cytotoxicity and allergic reactions due to induction of complement activation products and bradykinin.^{33, 34, 35}

This widespread reaction of the urethral mucosa results in extensive stricture formation involving the varying lengths of the anterior urethra in these subjects and this phenomenon had been observed previously by other authors.^{36,37,38} Report by Ruutu *et al.* and Nancey *et al.* demonstrated that use of pure silicone catheters significantly reduced the incidence of catheter-associated urethral strictures in their patients as these are inert and thus more biocompatible than the siliconized latex brands.^{34,39} This variety of pure silicone catheters are expensive and are not usually readily available in our communities coupled with the probable ignorance of medical staff of the causal

relationship between use of latex-coated urethral catheters and strictures.

Management of catheter-associated urethral strictures can be very challenging due to the extensive nature of the disease in these subjects and this is worsened by the cost of the surgeries, the near non-availability of the necessary training and expertise in urethral reconstruction in many of our hospitals.

Only one patient in this study had direct visual internal urethrotomy (DVIU) for a short- segment, incomplete bulbar stricture. Direct visual urethrotomy treats strictures by direct full thickness incision of the scar performed at the 12 o'clock position using an optical urethrotome.¹ Since its introduction into urology practice, DVIU has demonstrated a great appeal to the patients and practitioners due to its relative ease of performance, minimal resource requirement and short hospital stay.⁴⁰ The procedure may be carried out under a variety of regional and local anaesthetic techniques including spinal, local anaesthesia and its modifications.⁴¹ In properly selected patients and in well trained hands, DVIU has been found to be effective and dependable in treatment of short segment bulbar strictures with minimal spongiofibrosis.⁴² However, this procedure is not suitable for the long-segment strictures with the presence of severe spongiofibrosis found in most of our patients.

Urethral reconstruction in the patients with panurethral strictures can be accomplished by use of penile fasciocutaneous flaps or by use of oral mucosa grafts carried out either as one-stage or multiple-staged repairs.^{43,44,45} One of the patients in this series had one-stage urethroplasty using penile island fasciocutaneous flap as has been similarly reported by Poopola *et al.* who had a similar experience in the treatment of long-segment urethral strictures resulting from urethral catheterization.³⁸ One other patient in our series had first stage oral mucosa graft urethroplasty as a result of intra-operative finding of severe and extensive spongiofibrosis and near-total loss of urethral

plate, while the remaining twenty nine (29) subjects had single stage urethral reconstruction with oral mucosa grafts harvested from the cheek, lower lip and in few cases from the underlying lateral surface of the tongue.

Our choice of use of single stage oral mucosa grafts in the repair of these strictures was based on published data on the versatility, durability, ease of harvest, excellent take, minimal donor site morbidity as well as favourable outcome in the use of this urethral substitute tissue in reconstruction for panurethral strictures.^{46,47}

The one-stage repair in these patients has the advantages of single anaesthetic exposure, reduced cost of multiple-stage surgeries, in addition to reducing the duration of time patients were on the waiting list.

Successful outcome was found in 28 (87.5%) of patients as evidenced by satisfactory voiding on removal of the urethral catheter and subsequent urologic out-patient clinic visit and this result is comparable to those of Prabha *et al.*⁴⁵

Limitations of the study include the non-documentation in the case notes of the exact catheter brands, place of manufacture as well as the size of catheters used in each patient. Due to the retrospective nature of the study, there was no skin patch testing of the affected patients in order to establish presence of latex allergy so as to provide appropriate counsel to those with this problem.

CONCLUSION

Urethral catheterization is an emerging cause of panurethral strictures in our practice and this may occur even following short- term catheterization during the intra-operative period. Use of oral mucosa grafts in one-stage reconstruction gives good outcome.

Education of medical staff working in rural health facilities, emergency departments and operation rooms on the choice of the appropriate catheters as well as the technique of urethral catheterization will minimize this complication. There is also the need for the evaluation by the relevant government agencies of the quality of silicone-coated latex urethral catheters currently available in the country.

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