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Original Research Article

Aetiopathogenesis of urethral stricture disease in a tertiary hospital in Southern Nigeria

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ABSTRACT

Background: The urethra provides passage for urine in both sexes and additionally for ejaculation in males. Urethral stricture disease (USD), results in the narrowing of the urethra due to spongiofibrosis. Understanding the pathology of this disease is important to treatment. This study aims to evaluate the aetiology, pathology and pathogenesis of USD at the University of Port Harcourt Teaching Hospital.
Methods: This was a 6-year retrospective study conducted on all patients with features of USD who presented to the University of Port Harcourt Teaching Hospital UPTH. Ethical approval was sought and obtained from the hospital's ethical committee. Data were obtained from ward admission, theatre, and discharge records. The information gotten included the age of the patient, aetiologic agent, site of stricture, number of strictures, length of stricture and complications present at the presentation. The data retrieved was analysed and categorical data were presented in the form of frequencies and percentages using tables. Continuous variables were presented as means and standard deviation. Results were presented in tables and charts.
Results: The mean age from this study was 44.1±16.7 years. The commonest site of USD was bulbar with 74 (67.27%) patients. The commonest cause of urethral stricture was iatrogenic (41 patients).
Conclusions: Strictures are commonest amongst middle-aged men. The commonest site of urethral stricture disease is the bulbar region because of its unique anatomy. Iatrogenic strictures are the commonest cause of urethra stricture disease.

Keywords: Urethral stricture disease, Aetiology, Pathogenesis, Bulbar urethral strictures

INTRODUCTION

Urethral stricture disease (USD) is one of the oldest and commonest afflictions of the urethra in developing countries.[1] USD was described as early as the sixth century BC in ancient India. The disease provides a significant work burden for urologists.[2] Although it affects mostly adult males, it can also affect females and younger boys.[3,4] USD has a significant impact on a patient's quality of life and is associated with significant healthcare expenditure and morbidity.[5] The male urethra is divided into the anterior and posterior urethra. The anterior urethra is further subdivided into the glandular, penile and bulbar urethra. The posterior urethra is subdivided into the prostatic and membranous urethra.

USD is defined as the narrowing and loss of distensibility of any part of the urethra as a result of spongiofibrosis.[6] The disease refers to an injury of the urethral epithelium which results in scarring of the urethra covered by the corpus spongiosum.[4,7] Narrowing of the posterior urethra where there is no spongiosum is strictly not defined as strictures but as stenosis or contracture.[7]

Strictures are classified either as iatrogenic, traumatic, inflammatory or idiopathic. A good knowledge of the aetiology and pathology of USD is important for management.[7,8] USDs were mostly due to inflammatory causes and were associated with gonococcal urethritis.[6] Worldwide, there seems to be a change in the aetiology of strictures from inflammatory because of prompt and adequate management of urethritis. Traumatic and iatrogenic strictures seem to be on the increase because of an increase in accidents and endourological procedures.[7,9,10]

In Port Harcourt, an 11-year retrospective study was carried out to evaluate the pattern and management of USD by Ekeke et al from 2005 to 2015.[10] Another study was carried out by Raphael et al from January 2017 to January 2019 and concentrated more on the surgical management of posterior urethral stenosis.[11] Most studies conducted on urethral stricture disease in Nigeria emphasized treatment and few studies have been carried out on USD evaluating its aetiopathogenesis in Nigeria. This study aims to evaluate the aetiology, pathology and pathogenesis of USD in the University of Port Harcourt Teaching Hospital from January 2016 to December 2021.

METHODS

This was a retrospective study. Every patient with features suggestive of USD between January 2016 and December 2021 who presented to the University of Port Harcourt Teaching Hospital UPTH was included in the study. Port Harcourt is a major capital city in the Niger Delta, the oil and gas zone in Nigeria. Ethical approval was sought and obtained from the hospital's ethical committee.

Data from all patients listed in the medical records department as having been treated for USD during the study period were retrieved. Also, data were obtained from ward admission registers, theatre, and discharge records. The information gotten included history, duration of symptoms, examination findings, age of the patient, site of stricture, number of strictures, and length of stricture and treatment received. Patients who had stenosis of the posterior urethra were excluded from the study. All patients with incomplete records were also excluded from the study.

Each patient had a retrograde urethrogram and or micturating cystourethrogram, urinalysis/microscopy culture and sensitivity, full blood count and electrolyte urea and creatinine.

A short segment stricture was defined as one less than 2 cm. Any stricture longer than 2 cm was considered a long segment stricture. Any stricture with an intervening normal segment was described as being multiple.

The data from the folders were collected and entered using Microsoft Excel 2016 version and transferred into the statistical package for social sciences (SPSS) for windows (version 25) (IBM SPSS Inc. Chicago, IL) for analysis. Ninety-five percent confidence interval and a p-value less than 0.05 was considered significant. Frequencies, percentages, the mean and standard deviation was used to summarize the data as appropriate. The distribution of the strictures by the aetiology, type of investigations, length of stricture and the number of strictures was assessed using the chi-square statistic. Categorical data were presented in the form of frequencies and percentages using tables. Continuous variables were presented in means and standard deviation. Results were presented in tables and charts.

RESULTS

A hundred and eighty-three patients were evaluated but only 110 patients met the inclusion criteria and were included in the study. No female patient presented with features of USD during the study duration. The socio-demographic data are as documented.

Table 1: Demographic data of respondents.

Demographics	Frequency (n=110)	Percentage
Age groups (years)		
≤30	12	3.90
31-40	46	29.87
41-50	28	27.27
51-60	10	12.99
61-70	4	6.49
>70	10	19.48
Mean age±SD	44.1±16.7	
Median age (IQR)	40.0 (33-50)	
Minimum age	6	
Maximum age	95	
Modal age	32	

IQR: Interquartile range.

Table 1 shows a mean age of 44.1±16.7 years. The 31 to 40 years age group had the highest frequency of 46 years.

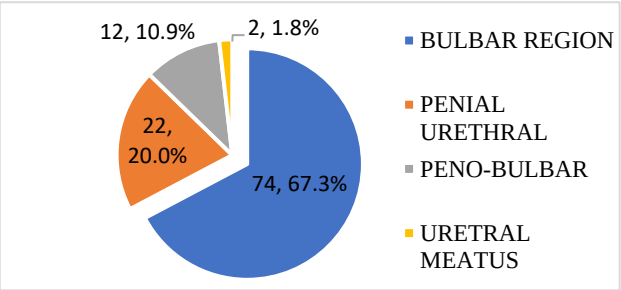

Figure 1: Distribution of strictures.

Figure 1 shows that the commonest site of urethral stricture disease is the bulbar urethra with 74 (67.27%) and the least common is at the urethral meatus with 2 (1.82%).

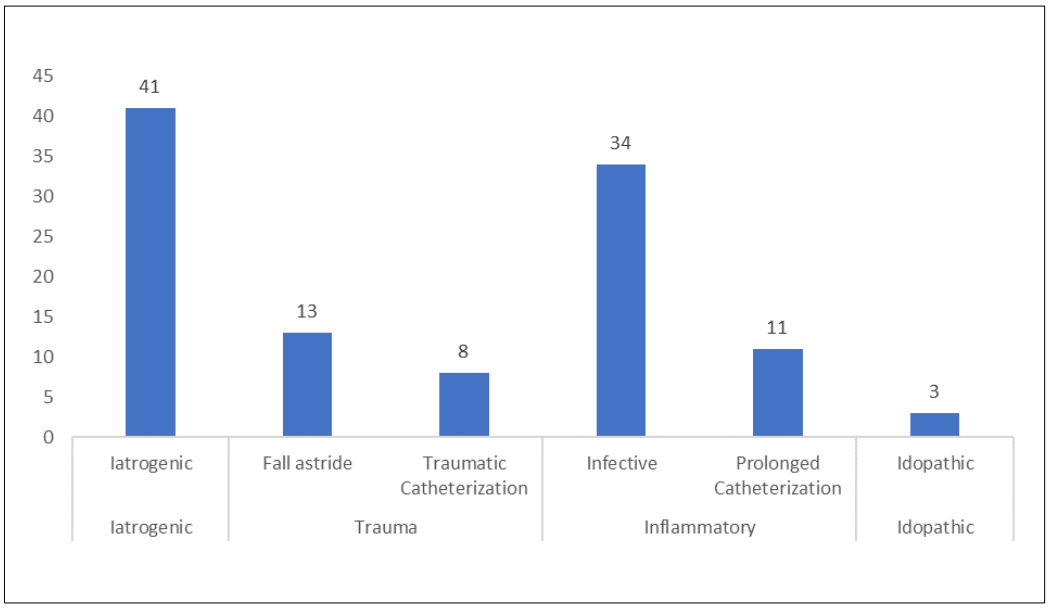

Figure 2: Aetiology of strictures, showing that iatrogenic stricture is the commonest cause of strictures.

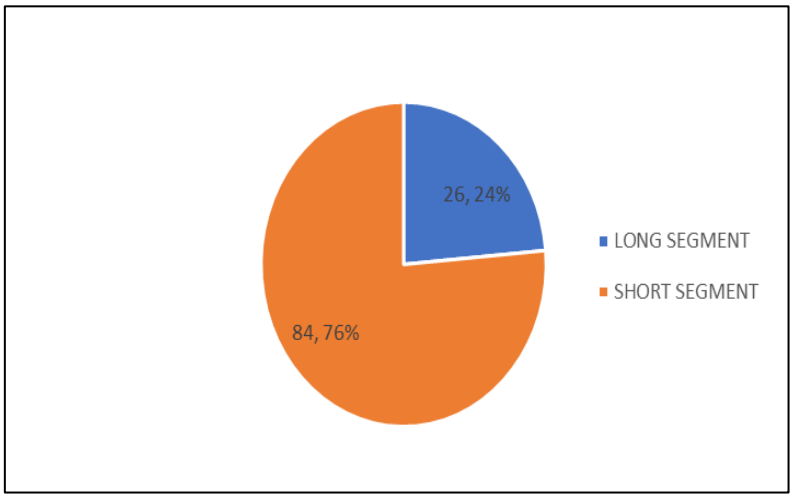

Figure 3: That 84 (76%) of patients presented with short-segment strictures while 26 (24%) present with long-segment strictures.

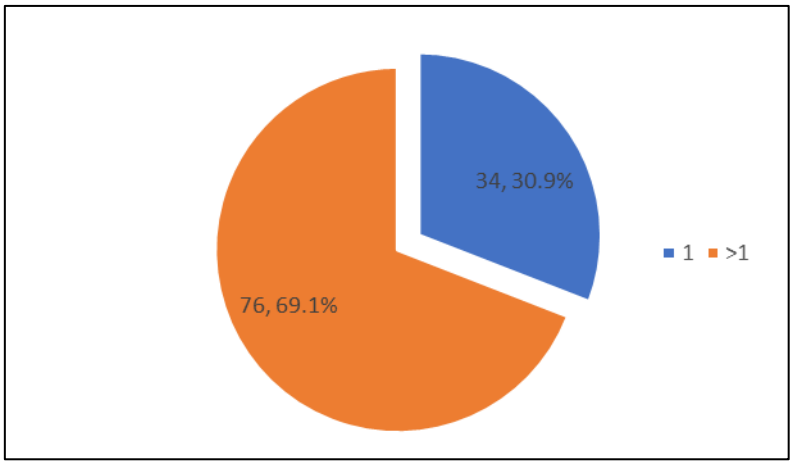

Figure 4: The number of strictures, 76 (69%) had more than one stricture.

Table 2: Distribution of stricture by the length of the stricture.

Strictures	Long segment	Short segment	Total
	N (%)	N (%)	N (%)
Bulbar	15 (20.3)	59 (79.7)	74 (100.0)
Penile	9 (37.5)	15 (62.5)	24 (100.0)
Peno-bulbar	2 (20.0)	8 (80.0)	10 (100.0)
Meatus	0 (0.0)	2 (100.0)	2 (100.0)

Chi-square =32.46, p<0.0001

Table 3: Distribution of stricture type by number.

Strictures	1	>1	Total
	N (%)	N (%)	N (%)
Bulbar region	23 (31.1)	51 (68.9)	74 (100.0)
Penial urethral	7 (31.8)	15 (68.2)	22 (100.0)
Peno-bulbar	2 (16.7)	10 (83.3)	10 (100.0)
Uretral meatus	2 (100.0)	0 (0.0)	2 (100.0)

Chi-square =8.42, p=0.048

Table 4: Distribution of complications before presentation.

Complications before presentation	Frequency	Percentage
Urinary tract infection	33	30
Haematuria	29	26.36
Acute urinary retention	15	13.64
Chronic urinary retention	10	9.09
Bladder stone	15	13.64
Perineal Fistula	8	7.27
Total	110	100

The distribution of the strictures by length. The short segment strictures were significantly the most common in all the parts of the urethra (Table 2).

The Table 3 showed that there was no statistically significant distribution of the number of strictures in the different parts of the urethra among the study subjects.

The most common complication was urinary tract infection (UTI) with 33 (30%) of patients presenting with UTI. The least common complication was a perineal fistula.

DISCUSSION

Urethral strictures result from circumferential scar formation in the epithelium and underlying corpus spongiosum of the urethra resulting in progressive narrowing of the urethral lumen.[12] The narrowing produces no symptom initially but becomes symptomatic in adults when the urethral lumen is less than 11 French gauge.[13] The effects of such narrowing can lead to lower urinary tract obstruction and present with lower urinary tract symptoms.[14] These symptoms can worsen and lead to hydronephrosis, pyelonephritis, renal compromise and even death.[15]

USD is rare in females and this index study no female patient presented with USD.[16-19] The disease is rare in females because the urethra is short and patulous. When USD is present in females the pathologies which result in scarring include tumours, inflammation or even trauma.[17,20] These pathologies result in the gradual narrowing of the urethral lumen resulting in USD.

An injury in the urethra by bacteria, physical or chemical insults results in progressive changes such as squamous metaplasia of the epithelium to stratified squamous, the squamous epithelium are less resistant to pressure changes and this results in fissures in the epithelium, extravasation of urine, fibrosis in the spongiosum which then coalesce to form stricture.[4] The narrowing restricts urine flow and causes dilation of the proximal urethra (prestenotic dilatation) and prostatic ducts. Structures beneath the spongiosum can also be affected. Time from injury to stricture is about 3 months for trauma but about 20 years for infective strictures depending on the amount and virulence of the organism.[6]

The mean age of urethral stricture disease in this study is 44.1±16.7 years with the 31 to 40 age group having the highest frequency of 46 (29.87%) patients as shown in Table 1. This mean age is similar to the mean age in studies conducted in Lagos[9] and Jos[14] with a mean age of

43.1 years and 39.5±19 years respectively. This mean age is slightly higher in other studies conducted in Illorin and Port Harcourt with a median age of 49.5 years and 48±9.24 years respectively.[10,21] Most men at this age are actively mobile and prone to road traffic accidents and other causes of urethral stricture disease. Also, an infective stricture which was the commonest in those older studies is due to recurrent gonococcal infection which tends to be symptomatic about 20 years after the infection.[4] So, if men have the infection for about 20 years (when they become sexually active), the stricture tends to present in their 40s. A study which reviewed the histology of tissues removed during urethroplasty revealed that chronic inflammatory cells are prevalent in a significant percentage of urethral stricture disease specimens.[22]

Anatomically, the bulbar urethra is not as protected as the rest of the urethra. The commonest site of strictures in this study is the bulbar urethra as shown in Figure 1 with 74 (67.27%) patients presenting with bulbar urethral stricture. The bulbar urethral stricture was also more common in an earlier study conducted in Port Harcourt and Illorin.[10,20] The least common stricture were strictures at the urethral meatus which may occur following circumcision in younger boys, or due to Lichen sclerosus (also known as balanitis xerotica obliterans) which is a chronic inflammatory hypomelanotic, lymphocyte-mediated skin disorder that affects the prepuce, glans and urethra leading to urethral stricture and meatal stenosis.[7,23] Lichen sclerosus is uncommon in African men.[24]

Strictures are classified into acquired or idiopathic.[25,26] Almost all strictures for which a cause can be identified are acquired.[26] Acquired strictures are subdivided into iatrogenic, traumatic and inflammatory. With an increase in endourological procedures, there is an increase in urethral stricture disease secondary to iatrogenic causes.[10] The commonest cause of urethral stricture disease in this study was iatrogenic with 41% of patients as shown in Figure 1. The results of this study agree with that conducted by Tritschler et al (with 45% iatrogenic strictures) and Mundy et al with iatrogenic strictures being the commonest cause of stricture in the penile urethra.[4,26] The results of this study were at variance with that conducted by Tijani et al and Ekeke et al who had traumatic strictures as the commonest cause of stricture with 72% and 74% respectively.[9,10] The bad state of the roads in the developing economies of Lagos and Port Harcourt and the use of motorcycles for commercial purposes could be the reasons for the rise in traumatic strictures in these studies. Also, the increase in civil unrest in Nigeria at that time led to more traumatic injuries.[10] Trauma to the bulbous urethra resulting from road traffic accident heals with spongiofibrosis hence resulting in USD. Traumatic catheterization of patients especially when they are unconscious (like after a head injury or after a cerebrovascular accident) or catheterization of an anaesthetized patient by untrained medical personnel can also lead to iatrogenic strictures. With the development of miniaturized urological instruments, it is expected that iatrogenic strictures should reduce.[7] Strictures caused by infection are the second most common cause of USD with 34 patients presenting with post-infective strictures. Most inflammatory strictures occur at the bulbar urethra because of dilatation and angulation of this part of the urethra leading to a reduction in the velocity of urine as it exits the urethra, the bulbar urethra also contains the highest number of periurethral glands, this allows the gonococcal organisms to settle at this region.[6] This gives enough time to cause infection and subsequently scar formation leading to urethral strictures. As we progress from the bulbar urethra to the urethral meatus, the percentage of inflammatory stricture reduces.

There also seems to be an increase in catheter-associated strictures. A retrospective study conducted in Sokoto, Nigeria amongst patients referred or who presented to Urology Unit between April 2011 and January 2016 revealed that mucosal injury during catheterization, inadequate lubrication, poor quality of the catheter, poorly trained medical personnel can lead to urethral stricture.[27] Strictures secondary to catheters reacting to the urethral mucosa are believed to be inflammatory in nature and occur because of reactions to chemicals used in making catheters such as latex.[4] These strictures are usually of varying length but occur at points of natural curvature in the urethra such as the bulbar region and can even affect the entire urethra (pan urethral).[4,27] The use of appropriately sized silicon catheters can prevent these strictures.[27]

Traumatic strictures are usually short segment simple strictures and occur at the point where the pubic bone impacts the relatively unprotected urethra during fall astride injury, while inflammatory strictures are usually long segments and can be multiple.[27] In this study long segment strictures were least common with 26 (24%) having long segment strictures as shown in Figure 3. The reason for this finding may be because infective strictures which are usually long segment strictures are fewer in this study.

The site of most strictures was the bulbar region and they were short segment and multiple, this finding was statistically significant as shown in Table 2 and Table 3. Iatrogenic strictures are the most common in this study and occur usually at the proximal bulbar region or penile urethra.[4] Inflammatory strictures were the next most common and are also mainly located at the bulbar region and are usually multiple.

Patients with USD who present late most time come down with complications. Initially, the patient presents with both voiding and storage symptoms as the bladder tries to compensate for the obstruction in the urethra by hypertrophy of the bladder muscles leading to trabeculation, formation of cellules, and diverticula formation.[29] At this stage the stricture is incomplete and urine can still exit the bladder, although with a poor

stream. If the obstruction persists decompensatory stage sets in; when the ureterotrigonal unit is compromised as a result of increased intravesical pressure leading to hydroureter and hydronephrosis.[15] In this decompensatory stage, the bladder may become unable to expel urine leading to progressively increasing residual volume of urine which then culminates into the retention of urine. Retention can be either acute or chronic. The flow of urine in the urinary tract; prevents the multiplication of bacteria since they are carried out of the urinary tract. Stasis of urine can lead to infection, reflux of infected urine to the upper urinary tract leads to pyelonephritis, pyonephrosis and later renal compromise.[29,30] Infected urine extravasating through the urethral mucosa results in periurethral abscesses, and multiple urethral abscesses coalesce rupturing through the skin and forming a fistula (watering can perineum).[4,6] In high-pressure chronic urine retention, the pressure buildup in the upper tract affects the function of the kidney leading to renal compromise.[31,32]

Retention of urine is a common complication in USD.[33] The most common complication before the presentation was UTI and thirty-three patients (30%) presented because of UTI in this study as shown in Table 5. The least common complication was fistula and 8 (7.27%) patients presented with perineal fistula. The second most common complication was a retention of urine with 25 (22.73%) patients presenting with retention (15 patients had acute retention while 10 had chronic retention), Studies conducted in Osogbo South Western Nigeria, also revealed that retention of urine is a common complication in patients with USD.[34] The low socioeconomic status of these patients may also be a reason for the late presentation. Haematuria was present in 29 (26.36%) patients presented with haematuria as seen in Table 4. Haematuria in these patients can be because of the UTI, the mucosa is oedematous and bleeds easily because of the stasis. Also, neovascularization of the hypertrophied bladder, since the new blood vessels formed are friable and bruise easily. Increased urea levels from renal compromise can lead to the formation of guanidinosuccinic acid and phenolic acid which impairs platelet aggregation.[35,36] With obstruction of urine, sediments within the urine can crystallize forming a bladder calculus.[37-39] In our study 15 (13.64%) patients presented with bladder calculus.

Limitations

This was a retrospective study, all the data needed from patients with urethral stricture disease could not be gotten, and this limited the sample size.

CONCLUSION

Strictures are commonest amongst middle-aged men. The commonest site of urethral stricture disease is the bulbar region because of its unique anatomy. Iatrogenic strictures are the commonest cause of urethra stricture disease in our environment.

Recommendations

Only well-trained healthcare professionals should be allowed to catheterize patients. Better training of health care professionals. Use of appropriately sized silicon catheters. Prevention of infective strictures by abstinence and safe sexual practices. Prompt and effective treatment of urethritis.

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