World Journal of Urology (2019) 37:661–666
https://doi.org/10.1007/s00345-019-02696-9

TOPIC PAPER

Specific characteristics of urethral strictures in a developing country (Brazil)

R. H. Astolfi[1] · B. R. Lebani[1] · R. K. Krebs[2] · A. C. Dias-Filho[3] · J. Bissoli[4] · A. G. Cavalcanti[5] · S. F. Ximenes[1,6] · R. P. Bertolla[1] · Julio J. Geminiani[1]

Received: 6 August 2018 / Accepted: 19 February 2019 / Published online: 27 February 2019

Abstract

Purpose Evaluate the main etiologies and clinical characteristics of male urethral stricture disease (USD) in Brazil.

Methods This multicentric study was performed using retrospective data collected from six Brazilian referral centers of urethral reconstruction. The database comprised data from 899 patients with USD who had undergone surgical treatment from 2008 to 2018. Age, stricture site and primary stricture etiology were identified for each patient.

Results The mean age was 52.13 ± 16.9 years. The most common etiology was iatrogenic (43.4%), followed by idiopathic (21.7%), trauma (21.5%) and inflammatory (13.7%). Of the iatrogenic causes, 59% were secondary to urethral instrumentation (60% by urethral catheterization and 40% by transurethral procedures), 24.8% by other procedures (prostatectomy, radiotherapy, postectomy) and 16.2% by failed hypospadia repairs. Pelvic fracture urethral distraction injuries were responsible for most of the trauma-related strictures (62.7%). When stratified by age, the most common stricture etiology was trauma in the 0–39 years old group (42.8%), idiopathic in the 40–59 years old group (32.4%) and iatrogenic in patients over 60 years old (68%). In regard to the stricture site, 80% presented with an anterior urethral stricture and 20% with a posterior stenosis. In the anterior stenosis group, the most common stricture site was bulbar (39.5%).

Conclusion In Brazil, as in many developed countries, the most common cause of urethral stricture diseases is iatrogenic, especially urethral catheterization. These findings emphasize the need of a careful urethral manipulation and a better training of healthcare professionals. Trauma is still responsible for a great proportion of strictures and inflammatory etiologies are now less frequently observed.

Keywords Urethral stricure · Ethiology · Iatrogenic disease · Urinary catheterization · Lichen sclerosus · Urethritis

Abbreviations

DVIU	Direct visual internal urethrotomy
EPA	Excision and primary anastomosis
LS	Lichen sclerosus
PFUDI	Pelvic fracture urethral distraction injury
USD	Urethral stricture disease

Introduction

Urethral stricture disease (USD) is one of the most challenging urological pathologies, frequently associated with significant impairment of the patient's quality of life [1] and imposing an important economic burden on the healthcare system. Patients affected by this condition are often subjected to numerous procedures, varying from simple urethral dilations to very complex reconstructive surgeries. Developed countries, such as the United States of America spend yearly an average of $6000 per person treating USD, with an estimated annual expenditure of almost $200 million [2]. In developing countries like Brazil, the socio-economic impact

✉ Julio J. Geminiani
juliogeminiani@gmail.com

1 Department of Surgery, Division of Urology, Sao Paulo Federal University (UNIFESP), São Paulo, Brazil

2 Division of Urology, Paraná Federal University (UFPR), Curitiba, Brazil

3 Division of Urology, Federal District Base Hospital, Brasília, Brazil

4 Division of Urology, University of São Paulo Medical School (FMUSP), São Paulo, Brazil

5 Urogenital Research Unit from Rio de Janeiro State University (UERJ), Rio de Janeiro, Brazil

6 Oswaldo Ramos Foundation, São Paulo, Brazil

is probably even greater due disparities in healthcare quality and access, social and environmental settings, as well as inherent regional differences [3, 4].

There are still insufficient epidemiological data regarding urethral stricture disease; its true prevalence is still unknown and stricture etiology can be affected by geographic settings and socio-economic factors [2]. In developed countries the most common etiologies are idiopathic (41%) and iatrogenic (35%) lesions [4–9]. In contrast, in the developing world, trauma (36%) and urethritis (54 to 66%) are still responsible for the majority of cases [10–12], reflecting higher rates of road traffic injuries and sexually transmitted diseases, as well as poor access to healthcare.

In Brazil, the largest country in South America and the world's sixth most populated [13], the main etiological factors for USD are still unknown. The Public Unified Health System (Sistema Único de Saúde—SUS) provides universal coverage and free access to all levels of health assistance to every person within its territory, which frequently leads to long waiting periods for exams and surgery and constantly suffers from the lack of financial resources. Furthermore, tertiary care centers and the best healthcare services are unevenly concentrated in the wealthier regions of the country, restricting the access from the majority of the population that resides in less-favored areas. A better understanding of the different etiologies and clinical characteristics of the USD in Brazil may help in the development of preventive measures by the public health system and also influence the therapeutic choices and clinical outcomes of this disease.

Material and methods

This multicentric study was performed using retrospective data collected from six Brazilian referral centers of urethral reconstruction: São Paulo Federal University (UNIFESP), University of Sao Paulo Medical School (FMUSP), Paraná Federal University (UFPR), Federal District Base Hospital, Rio de Janeiro State University (UERJ) and Oswaldo Ramos Foundation. The database comprised data from male patients with urethral stricture who had undergone surgical treatment (open and endourological procedures) from 2008 to 2018. Age, stricture site and the primary stricture etiology were identified for each patient using electronic medical records. All patients who chose not to undergo surgical management and those without an identifiable etiological factor for the USD mentioned in their records (including idiopathic) were excluded.

USD anatomical characteristics were determined by the treating surgeon during the procedure at each clinical site and classified according to its anatomic location as posterior or anterior, the latter further divided into navicular fossa, penile, bulbar, extended anterior (interrupted and concomitant strictures in the bulbar and penile urethra) and panurethral (long and uninterrupted penobulbar strictures). USD etiologies were subcategorized into idiopathic, inflammatory, iatrogenic and traumatic, following the recommendations of the International consultation of urological diseases [13]. The inflammatory subgroup included USD secondary to urethritis (sexually transmitted diseases) or lichen sclerosus (LS) (confirmed by anatomopathological study), and traumatic etiologies included pelvic fracture distraction injuries (PFUDI) and perineal trauma. The iatrogenic subgroup included urethral strictures secondary to medical procedures or to medical treatments, and was further subdivided into urethral instrumentation (traumatic urethral catheterization or endourological interventions), failed hypospadia repair and other etiologies (prostatectomy, postectomy, radiotherapy, etc.). Strictures without an identifiable etiology were considered idiopathic. All statistical analyses were performed using SPSS 17.0 for Windows. Descriptive statistics were carried out for continuous and categorical variables. When appropriate, frequencies were compared between groups using a Chi-square test. In these cases, the maximum alpha error was set at 5%.

Results

We evaluated the data of 899 patients with USD that underwent treatment between 2008 and 2018. The mean age was 52.13 ± 16.9 years (range 3–91) and the main etiologies of the study data are listed in Table 1. Most of the strictures were iatrogenic [388 (43.2%)], followed by idiopathic [195 (21.7%)] and trauma [193 (21.5%)] injuries. Inflammatory causes were less prevalent in our patients [123 (13.7%)], 66.7% of them secondary LS and 33.4% caused by infectious urethritis. Of the iatrogenic causes, 229 (59%) were secondary to urethral instrumentation (60.9% by urethral catheterization and 39.1% by transurethral procedures), 96 (24.8%) by other procedures (prostatectomy, radiotherapy, and postectomy) and 63 (16.2%) by failed hypospadia repairs. Pelvic fracture distraction injuries were responsible for most of the trauma-related strictures [121 (62.7%)], while perineal trauma history was present in 72 (37.3%) patients. When stratified by age, the prevalence of each etiology significantly differs, as represented in Fig. 1. Trauma was the most common stricture etiology in the 0–39 years old group [95 (42.8%)], idiopathic in the 40–59 years old group [99 (32.4%)] and, finally, iatrogenic in patients over 60 years old [210 (68%)]. Failed hypospadia repair corresponded to 61% of the iatrogenic causes in younger patients (0–39 years group).

In regard to the stricture site, 719 (80%) presented with an anterior urethral stricture and 180 (20%) with a posterior stenosis. In the anterior stenosis group, the most common

Table 1 General etiology of the urethral stricture disease in Brazil

Etiology	Patients (%)	% (from total)	Total (%)
Idiopathic			
Idiopathic	195	21.7	195 (21.7)
Inflammatory			
Lichen sclerosus	82 (67)	9.1	123 (13.7)
Post-urethritis	41 (33)	4.6	
Iatrogenic			
Urethral instrumentation	229 (59)	25.5	388 (43.2)
Others	96 (25)	10.7	
Post-hypospadia repair	63 (16)	7.0	
Traumatic			
Pelvic fracture distraction injuries	121 (63)	13.4	193 (21.4)
Perineal trauma	72 (37)	8.0	
Total	899	100	899 (100)

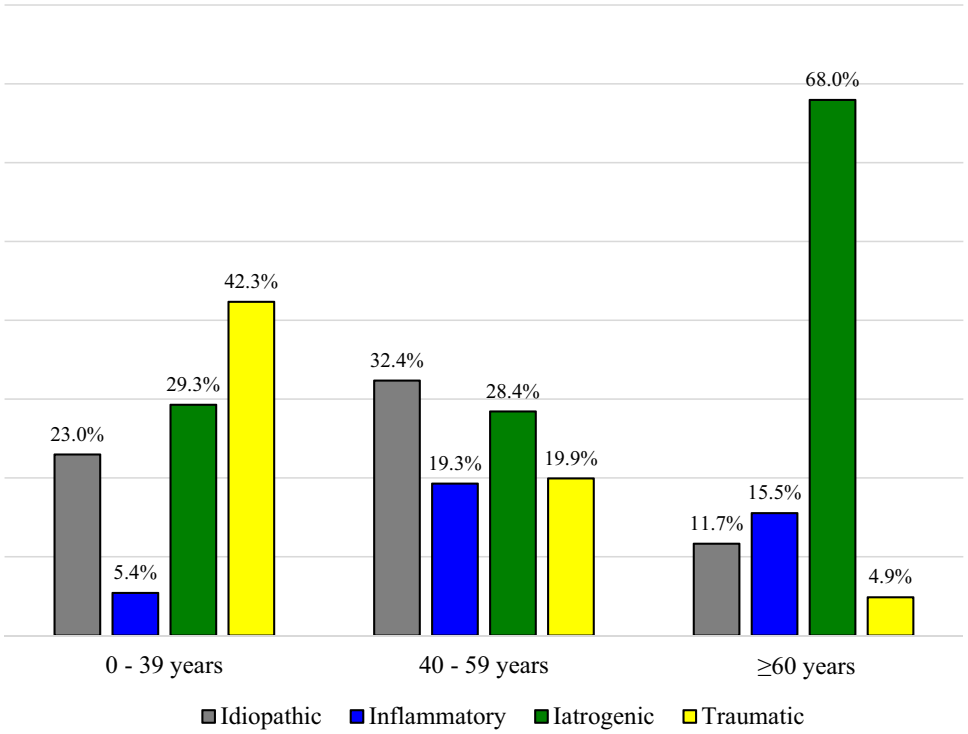

Fig. 1 USD etiology by age group

stricture site was bulbar [331 (39.5%)], followed by penile [155 (18.5%)], extended anterior [97 (11.6%)], panurethral [46 (5.5%)] and meatal [30 (3.6%)].

When data from each reconstructive center were analyzed separately, some differences were observed as shown in Table 2. In all centers, iatrogenic factors were the main causes of USD (38–45%). Trauma was the second most prevalent etiological factor for the USD treated by Krebs RK in UFPR (25%) and Bissoli J (35%). On the other hand, inflammatory etiology was the second most common factor for USD found by Cavalcanti AG (24%), mostly due to LS (74%).

Discussion

This multicentric study was, to our knowledge, the first to assess the main etiologies and clinical characteristics of the urethral stricture disease in a South American country. Brazil is a continent-sized country with several reconstructive medical centers and, although we managed to collect data from a large number of patients, the true Brazilian USD prevalence could not be determined, since the collected data derived from centers concentrated in the southeastern Brazilian region, that also provide assistance

Table 2 Etiology of urethral stricture disease in each reconstructive center

Authors	Strictures (*n*)	Etiology (%)			
		Idiopathic	Inflammatory	Iatrogenic	Traumatic
Geminiani JJ	119	29 (24)	13 (11)	50 (42)	27 (23)
Krebs RK	79	15 (19)	14 (18)	30 (38)	20 (25)
Cavalcanti AG	397	86 (22)	63 (16)	180 (45)	68 (17)
Ximenes SF	73	24 (33)	5 (7)	28 (38)	16 (22)
Dias Filho AC	171	33 (19)	24 (14)	73 (43)	41 (24)
Bissoli J	60	8 (13)	4 (7)	27 (45)	21 (35)
Total (%)	899	195 (22)	123 (14)	388 (43)	193 (21)

to many patients from other regions with less access to high-complexity health care assistance.

Several studies have demonstrated that the main USD etiologies have changed in the last few decades, especially in developed nations. In 1981, a review of 20 articles from 1961 to 1981 revealed that 40% of male urethral strictures were secondary to inflammatory causes [14]. Since then, large series from developed nations suggested a transition to a predominance of idiopathic and iatrogenic factors [4–9], while in developing countries inflammatory and traumatic injuries are still responsible for the majority of cases [5, 9–12]. Our findings have pointed iatrogenic factors as the main USD etiology in Brazil (43.2%), with a rate similar to that observed in other large series from the developed world [8, 15–17]. Urethral instrumentation represented the majority of the iatrogenic causes (59%) and was most often related to urethral catheterization (60.9%). Therefore, a more careful urethral management by doctors and healthcare assistants during catheterization and endoscopic procedures is essential and should be encouraged to avoid unnecessary trauma and spongiofibrosis formation [4, 6, 18, 19]. Moreover, since prolonged catheterizations have been related to USD due to urethral inflammation and ischemia, especially in hypovolemic patients, reducing catheterization period, using small caliber and silicone catheters, and a preventive placement of a suprapubic cystostomy in selected patients are all possible effective measures to avoid USD [6, 8, 20, 21]. Urethral strictures after failed hypospadia repair affected 7% of our patients and were the most important etiological iatrogenic factors in younger patients. The majority of these strictures develop at the distal penile urethra and often require complex surgical treatments; therefore, parents and patients should be informed about the risks of future USD before any intervention [22].

Trauma was responsible for a great proportion of USD in our casuistic (14–35%), most of them secondary to pelvic fracture distraction injuries (62.3%). The mechanism of these lesions involves compression of the pelvic ring, leading to a superior bladder displacement and consequent urethral stretching and avulsion at the bulbo-membranous junction [23]. Developing countries such as Brazil still have high rates of PFUDI due to poor traffic conditions and regulations combined with a lack of emergent urological interventions, increasing the risk of subsequent urethral stenosis [3, 4, 24]. The prevalence of traumatic injuries was also higher in younger patients, more susceptible to traffic and occupational accidents, progressively reducing with age (Fig. 1). A combination of preventive endeavors to reduce road traffic injuries, such as driver education improvement, communication campaigns and increased enforcement could have a positive impact on traumatic USD numbers, especially among younger drivers.

Idiopathic strictures were identified in a great number of our patients (21.7%), comparable to the rates observed in other series [1, 4, 6]. There is a significant demographic variation in the pattern of idiopathic etiology of USD in other series, with a trend toward higher prevalence in developed countries (18–44%) [3, 4, 8] when compared to developing countries (4–32%) [3, 9–12]. Higher rates of traumatic and inflammatory strictures in less favored regions, as well as differences in data collection or in the definition of the etiology may have contributed to this disparity. In regard to possible etiologies for idiopathic USD, the exact mechanism remains unknown. Unrecognized childhood trauma, congenital origin or result of ischemia are all possible hypothesis [2, 25, 26].

Post-inflammatory strictures may result from gonorrheal infection or urethritis by chlamydia or ureaplasma, as well as from autoimmune diseases such as LS [2]. Developed countries report LS as the most common cause for inflammatory strictures, while infectious urethritis remains predominant in developing countries [3–12]. In our series, inflammation corresponded only to 13.7% of the USD etiologies, most of them by LS (66.7%). The inflammatory process usually initiates at the glans, leading to meatal stenosis and progressively involving the anterior urethra, potentially resulting in complex panurethral strictures. The pathophysiology of LS is still poorly understood, but regional differences in prevalence suggest the involvement of genetic factors and environmental triggers, such a chronic inflammation and infection [21]. Better access to healthcare, improved public and sexual education, public

campaigns and widespread use of condoms have contributed to the reduction of infectious urethritis in developed countries and should be encouraged. In Brazil, greater access to primary care centers provided by the Public Unified Health System (SUS), even in remote regions, has improved the early diagnosis and treatment of urethritis, reducing the frequency of sequelae. However, although there has been an improvement on primary care access by SUS, tertiary and quaternary health centers, that could provide assistance to patients suffering from complex USD cases, are still unevenly distributed throughout the Brazilian territory, frequently making patients travel great distances for treatment and wait long periods for surgery.

The strength of this study resides on the fact that it was multicentric and that included one of the largest cohorts of patients with USD from a single country. On the other hand, the main bias lies in its retrospective nature, and that only patients submitted to surgical treatments were considered. A more detailed study of their USD causes (exact trauma mechanism, previous treatments, symptoms, etc.), as well as the outcomes of their surgical treatments were not possible to obtain due to the inherent characteristics of the Brazilian Public Healthcare system. Most of our patients reside in distant regions and are followed by local primary care doctors, having been transferred to these tertiary care centers only to undergo their surgical treatment. Despite this fact, strictures that require surgery are more severe and probably have a greater impact on the patient's quality of life; therefore, studying the main etiologies of these cases would bring a greater benefit to health care.

Conclusion

In Brazil, as in many developed countries, the most common causes of urethral stricture diseases are iatrogenic factor, such as transurethral procedures and, especially, urethral catheterization. These findings emphasize the need of a careful urethral manipulation and a better training of healthcare professionals. Trauma is still responsible for a great proportion of strictures, and inflammatory etiologies are now less frequently observed. USD affects all age groups, but the etiology is significantly different between them, with trauma-related injuries predominating in younger patients and iatrogenic factors in older ones. An increased interaction between different healthcare centers like those involved in this study is of paramount importance, since a better data integration and experience exchange between groups can promote a greater understanding of our patients and, consequently, help in the development of preventive measures and therapeutic strategies for the urethral stricture disease.

Author contributions RHA: data management, data analysis, manuscript writing. BRL: data management, manuscript writing. RKK: data collection. ACD-F: data collection. JB: data collection. AGC: data collection. SFX: data collection. RPB: data management, data analysis, manuscript editing. JJG: project development, data collection, data analysis, data management, manuscript editing.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. For this type of study formal consent is not required.

References

1. Santucci RA, Joyce GF, Wise M (2007) Male urethral stricture disease. J Urol 177(5):1667–1674. https://doi.org/10.1016/j.juro.2007.01.041
2. Smith TG III (2016) Current management of stricture disease. Indian J Urol 32(1):27–33
3. Stein DM, Thum DJ, Barbagli G et al (2013) A geographic analysis of male urethral stricture aetiology and location. BJU Int 112(6):830–834. https://doi.org/10.1111/j.1464-410X.2012.11600.x
4. Lumen N, Hoebeke P, Willemsen P et al (2009) Etiology of urethral stricture disease in the 21st century. J Urol 182(3):983–987. https://doi.org/10.1016/j.juro.2009.05.023
5. Mathur R, Aggarwal G, Satsangi B et al (2011) Comprehensive analysis of etiology on the prognosis of urethral strictures. Int Braz J Urol 37(3):362–370
6. Palminteri E, Berdondini E, Verze P et al (2013) Contemporary urethral stricture characteristics in the developed world. Urology 81(1):191–196. https://doi.org/10.1016/j.urology.2012.08.062
7. Kessler TM, Schreiter F, Kralidis G et al (2013) Long-term results of surgery for urethral stricture: a statistical analysis. J Urol 170(3):840–844. https://doi.org/10.1097/01.ju.0000080842.99332.94
8. Fenton AS, Morey AF, Aviles R et al (2005) Anterior urethral strictures: etiology and characteristics. Urology 65(6):1055–1058. https://doi.org/10.1016/j.urology.2004.12.018
9. Ahmed A, Kalayi GD (1998) Urethral stricture at Ahmadu Bello University Teaching Hospital, Zaria. East Afr Med J. 75(10):582–585
10. Fall B, Sow Y, Mansouri I et al (2011) Etiology and current clinical characteristics of male urethral stricture disease: experience from a public teaching hospital in Senegal. Int Urol Nephrol 43(4):969–974. https://doi.org/10.1007/s11255-011-9940-y
11. Hagos M (2008) The endoscopic treatment of urethral strictures in Mekelle, Ethiopia. Ethiop Med J 46(4):397–400
12. Hussain M, Askari H, Lal M et al (2013) Experience at a stricture clinic in a developing country. J Pak Med Assoc 63(2):234–238
13. Latini JM, McAninch JW, Brandes SB et al (2014) SIU/ICUD consultation on urethral strictures: epidemiology, etiology, anatomy, and nomenclature of urethral stenoses, strictures, and pelvic fracture urethral disruption injuries. Urology 83(3 Suppl):S1–7. https://doi.org/10.1016/j.urology.2013.09.009

14. De Sy WA, Oosterlinck W, Verbaeys A (1981) Le traitementdu retrecissement de l uretre masculine. Acta Urol Belg 49:101–102
15. Pitkamaki KK, Tammela TL, Kontturi MJ (1992) Recurrence of urethral stricture and late results after optical urethrotomy: comparison of strictures caused by toxic latex catheters and other causes. Scand J Urol Nephrol 26(4):327–331
16. Barbagli G, Guazzoni G, Lazzeri M (2008) One-stage bulbar urethroplasty: retrospective analysis of the results in 375 patients. Eur Urol 53(4):828–833. https://doi.org/10.1016/j.eururo.2008.01.041
17. Pensadoro V, Emiliozzi P (1996) Internal urethrotomy in the management of anterior urethral strictures:long-term followup. J Urol 156(1):73–75
18. Rassweiler J, Teber D, Kunz R et al (2006) Complications of transurethral resection of the prostate (TURP): incidence, management and prevention. Eur Urol 50:969–979. https://doi.org/10.1016/j.eururo.2005.12.042
19. Kashefi C, Messer K, Barden R et al (2008) Incidence and prevention of iatrogenic urethral injuries. J Urol 179:22254–22257. https://doi.org/10.1016/j.juro.2008.01.108
20. Talja M, Virtanen J, Andersson LC (1986) Toxic catheter and diminished urethral blood circulation in the induction of urethral strictures. Eur Urol 12(5):340–345
21. Ruutu M et al (1984) Unexpected urethral strictures after short-term catheterization in open heart surgery. Scand J Urol Nephrol 18(1):9–12
22. Abu-Arafeh W, Chertin B, Zilberman M et al (1998) One-stage repair of hypospadias—experience with 856 cases. Eur Urol 34(4):365–367
23. Casselman RC, Schillinger JF (1977) Fractured pelvis with avulsion of the female urethra. J Urol 117(3):385–386
24. Kulkarni SB, Barbagli G, Kulkarni JS (2010) Posterior urethral stricture after pelvic fracture urethral distraction defects in developing and developed countries, and choice of surgical technique. J Urol 183(3):1049–1054. https://doi.org/10.1016/j.juro.2009.11.045
25. Baskin LS, McAninch JW (1993) Childhood urethral injuries: perspectives on outcome and treatment. Br J Urol 72(2):241–246
26. Depasquale I, Park AJ, Bracka A (2000) The treatment of balanitis xerotica obliterans. BJU Int 86(4):459–465
27. Andrich DE, Mundy AR (2008) What is the best technique for urethroplasty? Eur Urol 54(5):1031–1041. https://doi.org/10.1016/j.eururo.2008.07.052
28. Murphy R (2010) Lichen sclerosus. Dermatol Clin 28(4):707–715. https://doi.org/10.1016/j.det.2010.07.006