

UNIVERSIDADE FEDERAL DO PARANÁ

TIAGO CESAR MIERZWA

ANÁLISE DA CONSTRUÇÃO DE UMA CURVA DE APRENDIZADO EM
CIRURGIAS DE URETRA REALIZADAS POR UM ÚNICO CIRURGIÃO EM
UM HOSPITAL UNIVERSITÁRIO

CURITIBA

2023

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Dissertação apresentada ao Curso de Pós Graduação em Clínica Cirúrgica do Setor de Ciências da Saúde da Universidade Federal do Paraná, como requisito parcial para obtenção do título de Mestre.

Orientador: Prof. Dr. Rogério de Fraga
Coorientador: Dr. Rodrigo Ketzer Krebs

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Os membros da Banca Examinadora designada pelo Colegiado do Programa de Pós-Graduação MEDICINA (CLÍNICA CIRÚRGICA) da Universidade Federal do Paraná foram convocados para realizar a arguição da Dissertação de Mestrado de **TIAGO CESAR MIERZWA** intitulada: **ANÁLISE DA CONSTRUÇÃO DE UMA CURVA DE APRENDIZADO EM CIRURGIAS DE URETRA REALIZADAS POR UM ÚNICO CIRURGIÃO EM UM HOSPITAL UNIVERSITÁRIO**, sob orientação do Prof. Dr. ROGERIO DE FRAGA, que após terem inquirido o aluno e realizada a avaliação do trabalho, são de parecer pela sua aprovação no rito de defesa.

A outorga do título de mestre está sujeita à homologação pelo colegiado, ao atendimento de todas as indicações e correções solicitadas pela banca e ao pleno atendimento das demandas regimentais do Programa de Pós-Graduação.

CURITIBA, 01 de Dezembro de 2023.


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“Se o dinheiro for a sua esperança de independência, você jamais a terá. A única segurança verdadeira consiste numa reserva de sabedoria, de experiência e de competência.” (Henry Ford)

RESUMO

Introdução: Estenoses uretrais são uma condição incomum com um impacto significativamente negativo na vida dos pacientes. O resultado pós-operatório depende de vários fatores, como idade, comorbidades (diabetes, obesidade, estado cardiovascular), etiologia, tabagismo, imunossupressão e tratamentos urológicos prévios. Na formação de uma curva de aprendizado, muitos fatores são importantes, sendo que devido à complexidade da doença, ela pode levar anos pra concretizar. Portanto, a experiência do cirurgião tem sido associada aos resultados. **Objetivos:** Avaliar o impacto da curva de aprendizado no tratamento de estenoses uretrais por meio de diferentes técnicas de uretroplastia, bem como os principais fatores de risco associados às taxas de recorrência. **Métodos:** De fevereiro de 2015 a fevereiro de 2021, foram avaliados 174 prontuários médicos de pacientes submetidos à uretroplastia por um único cirurgião. Diferentes técnicas cirúrgicas foram aplicadas de acordo com as necessidades de cada caso. Considerou-se um acompanhamento pós-operatório mínimo de seis meses para analisar o desfecho, e a uretroplastia bem-sucedida foi definida como a ausência da necessidade de tratamento adicional. **Resultados:** A principal causa de estenose foi pós-traumática, em 27,10% dos casos, seguida por causas inflamatórias e iatrogênicas, com 25,25% cada, e, finalmente, foi encontrada uma origem idiopática em 22,40% desta amostra. Em 34,6% dos casos, o local da estenose estava na uretra bulbar, seguido pela uretra peniana (24,5%). O envolvimento panuretral foi observado em 13,4% da amostra e da uretra membranosa em 11,1%. Houve 30 casos (17,2%) de recorrência nos primeiros 6 meses de acompanhamento pós-cirurgia, sem diferença nas taxas de recorrência até 6 meses. **Conclusão:** A uretroplastia é um procedimento com uma longa curva de aprendizado, portanto, compreender os fatores associados à recorrência, para treinamento, pode ajudar na curva de aprendizado, assim como em outras cirurgias.

Palavras Chaves: Curva de aprendizado; Estenose de uretra; Procedimento Cirúrgico Urológico, uretroplastia

ABSTRACT

Introduction: Urethral strictures are an uncommon condition with a significantly negative impact on patients' lives. The postoperative outcome depends on various factors such as age, comorbidities (diabetes, obesity, cardiovascular status), etiology, smoking, immunosuppression, and prior urological treatments. In the learning curve formation, many factors are crucial, and due to the complexity of the disease, it may take years to solidify. Therefore, the surgeon's experience has been associated with outcomes. **Objectives:** To assess the impact of the learning curve in the treatment of urethral strictures using different urethroplasty techniques, as well as the main risk factors associated with recurrence rates. **Methods:** From February 2015 to February 2021, 174 medical records of patients undergoing urethroplasty by a single surgeon were evaluated. Various surgical techniques were applied according to the needs of each case. A minimum postoperative follow-up of six months was considered to analyze the outcome, and successful urethroplasty was defined as the absence of the need for additional treatment. **Results:** The primary cause of stricture was post-traumatic in 27.10% of cases, followed by inflammatory and iatrogenic causes, each with 25.25%, and an idiopathic origin was found in 22.40% of this sample. In 34.6% of cases, the stricture site was in the bulbar urethra, followed by penile urethra (24.5%). Panurethral involvement was observed in 13.4% of the sample, and membranous urethra involvement in 11.1%. There were 30 cases (17.2%) of recurrence in the first 6 months of post-surgery follow-up, with no difference in recurrence rates up to 6 months. **Conclusion:** Urethroplasty is a procedure with a steep learning curve; therefore, understanding factors associated with recurrence for training purposes can aid in the learning curve, as well as in other surgeries.

Keywords - Learning Curve; Urethral Stricture; Urologic Surgical Procedure; urethroplasty

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1. INTRODUÇÃO

A estenose de uretra (E.U.) é uma condição caracterizada pela lesão do epitélio uretral e subsequente fibrose do tecido esponjoso subjacente, resultando no estreitamento do lúmen uretral e, por conseguinte, na diminuição ou interrupção do fluxo urinário. Dentre as diversas etiologias, destacam-se as causas iatrogênicas, decorrentes de procedimentos médicos anteriores, e as causas inflamatórias, mais prevalentes em regiões desenvolvidas (ROURKE e HICKLE, 2012).

A compreensão da verdadeira prevalência da estenose de uretra foi aprofundada por meio dos estudos de SANTUCCI et al. em 2007. Essas pesquisas evidenciaram um aumento progressivo na incidência dessa condição com o avanço da idade, variando de 100 casos por 100.000 homens na terceira década de vida para 1.000 casos por 100.000 em homens com mais de 65 anos. A variação na incidência associada à idade está relacionada a diversos fatores intrínsecos do paciente. Traumas uretrais de origem externa, como acidentes e fraturas pélvicas, são as causas mais comuns em indivíduos mais jovens, enquanto em pacientes idosos, a incidência aumenta devido a fatores relacionados ao envelhecimento, incluindo comorbidades como diabetes, hipertensão, tabagismo, hipogonadismo, infecções, uso de sonda uretral e procedimentos endourológicos para tratar patologias prostáticas, vesicais e renais (SANTUCCI et al., 2007).

Em termos econômicos, o diagnóstico e tratamento da estenose de uretra foram estimados em cerca de 200 milhões de dólares em 2002, com um custo anual aproximado de 6.000 dólares por paciente nos Estados Unidos (PEARLE et al., 2005).

O diagnóstico da estenose de uretra se baseia na uretrocistografia, que fornece informações cruciais sobre a localização, extensão e complicações associadas à estenose, sendo essencial para o planejamento cirúrgico. A ultrassonografia, embora não seja de praxe, quando realizada demonstra alta precisão na avaliação de estenoses, especialmente em relação à extensão da espongiofibrose e ao diâmetro da lesão. A ressonância magnética é aplicável principalmente no diagnóstico de lesões de uretra posterior. Além

disso, a fluxometria urinária serve como marcador do status urinário pré e pós-operatório (PAVLÍCA e MENCHI, 2003).

O tratamento da estenose de uretra frequentemente envolve procedimentos como dilatação uretral e uretrotomia interna, abordagens menos invasivas e mais familiares aos urologistas. No entanto, a eficácia dessas intervenções varia consideravelmente, com estudos evidenciando melhores resultados nas estenoses menores que 1,5 cm e com pouca espogiofibrose, conseguindo taxas de sucesso próximos de 75%. (DUGI et al., 2015; MOREY e McANINCH, 2015).

Desde os anos 1990, as técnicas cirúrgicas para corrigir estenoses uretrais têm evoluído constantemente, resultando em resultados mais consistentes a longo prazo (MOREY e McANINCH, 2015; MUNDY e ANDRICH, 2011).

A escolha da abordagem terapêutica adequada é multifatorial, dependendo de fatores como etiologia da estenose, idade do paciente, extensão, localização, grau de espogiofibrose, exposição prévia à radiação e envolvimento de tecidos vizinhos (MARTINS et al., 2015).

O desfecho pós-operatório de pacientes submetidos à uretroplastia é influenciado por uma série de variáveis. Além dos fatores tradicionalmente considerados em cirurgias, como idade, tabagismo, imunossupressão e comorbidades (incluindo diabetes e obesidade), existem variáveis específicas da uretroplastia que desempenham um papel fundamental nos resultados. Essas variáveis incluem as características da estenose (obliterativa versus não obliterativa), tipo de enxerto utilizado, histórico de hipospádia, presença de liquen escleroatrófico e técnica cirúrgica empregada (ANDRICH et al., 2001; LEVINE et al., 2015).

Além disso, a uretroplastia é uma cirurgia que demanda um extenso período de aprendizado, uma vez que os cirurgiões precisam dominar diversas técnicas cirúrgicas, incluindo a transferência de retalhos e enxertos. Portanto, a experiência do cirurgião também está associada a melhores resultados e menores taxas de recorrência (MOREY e McANINCH, 2015).

Devido à complexidade e à diversidade das etiologias da estenose uretral, ao longo da história, foram descritas inúmeras técnicas cirúrgicas. Com os avanços no entendimento do funcionamento de enxertos e retalhos, bem como na evolução de fios de sutura e materiais, a literatura médica apresenta uma ampla variedade de procedimentos cirúrgicos (BARBAGLI et al., 2005). Isso significa que abordagens cirúrgicas anteriormente abandonadas podem ser reavaliadas, e técnicas híbridas que combinam diferentes procedimentos podem ser utilizadas (MUNDY e ANDRICH, 2011). Assim, a compreensão e a proficiência em diversas técnicas cirúrgicas e a construção de uma sólida curva de aprendizado são elementos cruciais (LEWIS et al., 2002).

Diferentemente de procedimentos cirúrgicos com pouca variação técnica, como a prostatectomia radical, nefrectomia ou pieloplastia, a cirurgia de uretra exige a construção de uma curva de aprendizado mais complexa. Isso se deve à diversidade de casos, a necessidade de dominar procedimentos que abrangem desde a transferência de tecidos até osteotomias, bem como a capacidade de trabalhar com tecidos desvitalizados ou irradiados (MOREY e McANINCH, 2015). Portanto, a experiência do cirurgião desempenha um papel fundamental no alcance de melhores resultados nas cirurgias de uretra, e a constante busca por aprimoramento e aprendizado é essencial para garantir o sucesso no tratamento das estenoses uretrais.

2. OBJETIVO

O objetivo primário desse estudo foi determinar o impacto da curva de aprendizado nos resultados das cirurgias de uretra, identificando a taxa de recidiva de acordo com o ganho de experiência do cirurgião.

O objetivo secundário foi identificar o impacto dos principais fatores de risco associados a recidiva em até 6 meses do tratamento.

3. MATERIAIS E MÉTODOS

3.1 Critérios de seleção

Este estudo consiste na avaliação retrospectiva do prontuário de 174 pacientes submetidos a uretroplastia no período de fevereiro de 2015 até fevereiro de 2021, por um único cirurgião, contados a partir do primeiro caso realizado pelo mesmo. Os procedimentos foram realizados no Complexo Hospital de Clínicas da Universidade Federal do Paraná (CHC-UFPR), em pacientes do sistema público de saúde. Os critérios de seleção foram pacientes de ambos os sexos com mais de 18 anos, diagnosticados com estenose de uretra e submetidos a uretroplastia. Os dados foram coletados após aprovação pelo comitê de ética da instituição (No: 15240119.5.0000.0096).

3.2 - Técnica cirúrgica

Diversas técnicas cirúrgicas foram utilizadas, de acordo com cada caso. Desde o início da casuística foram realizados casos de menor e maior complexidade, visto a necessidade de tratamento do sistema de saúde. Técnicas empregadas foram: uretroplastias anteriores e posteriores, uretroplastias com uso de enxertos ou retalhos cutâneos e uretroplastias estagiadas.

3.3 Definição de resultado

O seguimento mínimo considerado para o trabalho foi de seis meses após a cirurgia e a definição de falha de tratamento (recidiva) foi de necessidade de nova instrumentação da uretra sob sedação (excluíram-se pacientes submetidos a autocateterismo), a partir da queixa do paciente de redução do fluxo urinário no período pós-operatório (DUGI et al., 2015; MOREY e McANINCH, 2015).

3.4 Variáveis analisadas

Os dados analisados foram: idade, gênero, índice de massa corporal (Kg/m^2), etnia, etiologia da estenose, comorbidades (hipertensão arterial sistêmica e diabetes melitos), tabagismo, local e extensão da estenose, presença de líquen escleroatrófico, realização de tratamentos prévios, uso de cistostomia, técnica cirúrgica utilizada e recorrência em até 6 meses.

Os casos foram classificados de acordo com a complexidade determinada no serviço, resultando em dois grupos: Grau 1: Meatoplastia, uretroplastia término-terminal, uretroplastia com enxerto de mucosa oral inferior a 3 cm, uretroplastia com retalho inferior a 3 cm e uretostomia perineal (Figura 1). Grau 2: Uretroplastia com enxerto de mucosa oral superior a 3 cm (Figura 2), uretroplastia com retalho superior a 3 cm, uretroplastia de múltiplos segmentos, uretroplastia pós-recorrência, uretroplastia em caso de panestenose e uretroplastia posterior.

3.5 Análise estatística

Variáveis qualitativas foram descritas através das frequências absolutas e relativas, e variáveis quantitativas através das médias e desvio padrão. Comparações de variáveis qualitativas entre grupos foram realizadas pelo teste exato de Fisher, e no caso de variáveis quantitativas a comparação foi realizada pelo teste t de Student, valores de p menores que 0,05 foram considerados significativos.

4. ARTIGO

Os dados da presente tese - resultados e discussão foram enviados para publicação na revista Turkish Journal of Urology na presente forma de artigo que segue.

Nota: Comentários da banca relacionados ao artigo foram discutidos com o orientador e co-orientador e serão incluídos no artigo conforme o mesmo tenha o primeiro retorno para reavaliação da revista.

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Urology Research and Practice

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Title
Analysis of learning curve construction in urethral surgery performed by a single surgeon in a Brazilian University Hospital

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Krebs, Rodrigo
de Fraga, Rogerio

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Analysis of learning curve construction in urethral surgery performed by a single surgeon in a Brazilian University Hospital

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Manuscript Type:	Original Article
Keywords:	Learning Curve, Urethral Stricture, Urologic Surgical Procedure
Abstract:	<p>Background: Urethral strictures are a common condition with a significant negative impact on patients' lives. Postoperative outcome depends on several factors, such as age, comorbidities, etiology, smoking, immunosuppression, and previous urological treatments. Therefore, surgeon experience has been associated with the outcomes.</p> <p>Objectives: Evaluate the impact of the learning curve over the treatment of urethral strictures through different urethroplasty techniques, as well the main risk factors associated with recurrence rates. Methods: From February 2015 thru February 2021, 174 medical records of patients who underwent urethroplasty by a single surgeon were assessed. Different surgical techniques were applied according to the requirements of each case. A minimum of six months post-operative follow-up was considered to analyze the endpoint and successful urethroplasty was defined as the absence of the need for additional treatment.</p> <p>Results: The main cause of stricture was post-traumatic, 27.10% of cases, followed by inflammatory and iatrogenic with 25.25% each, and finally it was found 22,40% of this sample with idiopathic origin. In 34.6% of cases the site of the stricture was at the bulbar urethra, followed by penile urethra (24.5%). Panurethral involvement was seen in 13.4% of the sample and membranous urethra in 11.1%. There were 30 cases (17.2%) of recurrence in the first 6 months of follow-up after surgery, with no difference in recurrence rates up to 6 months.</p> <p>Conclusion: Urethroplasty is a procedure with a long learning curve, so understanding the factors associated with recurrence, for training may help the learning curve, as in other surgeries.</p>

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3 “Analysis of learning curve construction in urethral surgery performed by a single
4 surgeon in a Brazilian University Hospital”.

7 **Abstract**

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10 **Background:** Urethral strictures are a common condition with a significant
11 negative impact on patients' lives. Postoperative outcome depends on several
12 factors, such as age, comorbidities, etiology, smoking, immunosuppression, and
13 previous urological treatments. Therefore, surgeon experience has been
14 associated with the outcomes. **Objectives:** Evaluate the impact of the learning
15 curve over the treatment of urethral strictures through different urethroplasty
16 techniques, as well the main risk factors associated with recurrence rates.
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18 **Methods:** From February 2015 thru February 2021, 174 medical records of
19 patients who underwent urethroplasty by a single surgeon were assessed.
20 Different surgical techniques were applied according to the requirements of each
21 case. A minimum of six months post-operative follow-up was considered to
22 analyze the endpoint and successful urethroplasty was defined as the absence
23 of the need for additional treatment. **Results:** The main cause of stricture was
24 post-traumatic, 27.10% of cases, followed by inflammatory and iatrogenic with
25 25.25% each, and finally it was found 22,40% of this sample with idiopathic origin.
26 In 34.6% of cases the site of the stricture was at the bulbar urethra, followed by
27 penile urethra (24.5%). Panurethral involvement was seen in 13.4% of the sample
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29 in the first 6 months of follow-up after surgery, with no difference in recurrence
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31 learning curve, so understanding the factors associated with recurrence, for
32 training may help the learning curve, as in other surgeries.
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51 **Keywords** - Learning Curve; Urethral Stricture; Urologic Surgical Procedure
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Main Points:

Learning curve in urethroplasties is prolonged due to the various techniques required for treating urethral strictures.

In patients from the Brazilian public healthcare system, it is challenging to ensure equal follow-up for all patients, especially those who are asymptomatic.

Several factors can influence the outcome of urethroplasty.

Being a referral hospital, it had to manage cases of both higher and lower complexity simultaneously.

During the learning curve, supervised surgeries and training in laboratory models are essential.

For Review Only

Introduction

Urethral strictures are an uncommon condition but with a significant negative clinical impact on patients' lives. The most common causes are iatrogenic urethral injury and inflammatory (secondary to urethritis), with a higher prevalence in developed regions of the world [1]. The most proposed treatments are urethral dilatation or internal urethrotomy, as these are less invasive procedures and more commonly performed by urologists, but with variable success rates [2].

Since the 1990s, urethral surgery has been evaluated with more consistent long-term results [2,3]. The surgical treatment is determined by factors such as etiology, age, length, and location of the stricture, degree of spongiofibrosis, radiation exposure and adjacent tissue involvement [4].

On the same way, the postoperative outcome depends on several factors, such as age, smoking, immunosuppression, comorbidities as diabetes and, obesity, previous treatments, which may affect the outcome of any type of surgery. For urethroplasties, however, it is added to other conditions such as the characteristics of the strictures (obliterans versus non-obliterans, graft versus flap, history of hypospadias, presence of lichen sclerosus, and surgical technique) [1,2,4-10]. In addition, the learning curve for urethral surgery is extensive, as the surgeon must master several surgical techniques, as well as flap particularities and graft transfer. Therefore, surgeon experience is also associated with a risk of recurrence, as surgeons with low experience have higher recurrence rates [2].

As urethral strictures has multiple etiologies, over time, diverse techniques have been described. Advances in understanding of grafting, flaps, sutures and, materials has led to countless techniques been described. As result, surgical tactics that may have been abandoned in the past are now being reconsidered, and hybrid techniques that combine different procedures are now applied [4]. In contrast to other procedures, where there are few variations in the surgical procedure, such as radical prostatectomy, nephrectomy or even pyeloplasty, the learning curve for urethroplasty depends on factors such as the complexity of the case, knowledge of different techniques from tissue transfer to osteotomy, and

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3 working with devitalized or irradiated tissue. Therefore, the main aim is to
4 evaluate the impact of the learning curve in the treatment of urethral strictures
5 using different urethroplasty techniques, as well as the main risk factors
6 associated with higher recurrence rates in this series.
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10 11 12 13 **Patients and Methods**

14 15 16 17 Outcome measures

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19 The primary aim of this study was to determine the effect of the learning
20 curve on the outcome of urethral surgery. The recurrence rate was determined
21 according to the surgeon's level of experience. The secondary objective was to
22 determine the impact of risk factors that are associated with a recurrence within
23 the first 6 months after treatment.
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30 31 32 Patient population

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34 This study was a retrospective assessment of the medical records of 174
35 patients who underwent urethroplasty by a single surgeon from February 2015 to
36 February 2021, counted from the first case he performed in his career. The
37 surgical procedures were performed at UFPR University Hospital (CHC-UFPR)
38 on patients from the Brazilian Public Health System (SUS). Patients of both sexes
39 aged over 18 years diagnosed with urethral strictures and undergoing
40 urethroplasty were included. The data was collected after obtaining permission
41 from our institutional ethical committee (No.: 15240119.5.0000.0096).
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50 51 Surgical technique

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53 Different surgical techniques were used according to the needs of each
54 case. Since the beginning of the casuistry, cases of lower and higher complexity
55 have been performed according to the treatment needs of the health system.
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3 Surgical techniques were: one-stage anterior or posterior urethroplasty, using
4 substitute tissues (skin flaps or grafts) and, multi-stage urethroplasty.
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9 Definition of variables

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12 The variables analyzed were: age, gender, body mass index (BMI),
13 ethnicity, etiology of stenosis (idiopathic, iatrogenic, lichen sclerosus related, or
14 traumatic), comorbidities (Diabetes or High Blood Pressure), smoking history
15 (yes or no), stenosis location and length, history of previous procedures,
16 presence or not of suprapubic tube, which surgical technique, and recurrence
17 within 6 months post-operative.
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23 The cases were classified according to the complexity determined in the
24 service, resulting in two groups: Grade 1: Meatoplasty, end-to-end urethroplasty,
25 urethroplasty with oral mucosal graft less than 3 cm, urethroplasty with a flap less
26 than 3 cm, and perineal urethrostomy (Figure 1). Grade 2: Urethroplasty with oral
27 mucosal graft greater than 3 cm (Figure 2), urethroplasty with a flap greater than
28 3 cm, multi-segment urethroplasty, post-recurrence urethroplasty, urethroplasty
29 in case of panstenosis, and posterior urethroplasty.
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36 Follow-up and outcome definition

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38 A minimum of six months post-surgery follow-up was considered for this
39 analysis and successful urethroplasty was defined as the absence of the need
40 for additional treatment. The demand for re-instrumentation of the urethra, based
41 on the patient's complaint of reduced urinary flow in the post-operative period
42 (QoL-visual analog scale), as the definition of treatment failure (recurrence)^[11-14].
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50 Statistical analysis

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52 Qualitative variables were described by absolute and relative frequency,
53 as quantitative variables by mean and standard deviation. Comparisons were
54 made using Fisher's exact test for qualitative variables and paired t-test for
55 quantitative variables, *p* values less than 0.05 were considered significant. All
56 statistical analyses were performed using R software v. 4.1.1
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Results

Descriptive characteristics of the 174 patients who underwent urethroplasty are shown in Table 1. The mean age of the patients was 53 years, with a mean BMI of 26.9 kg/m². The main cause of stricture was post-traumatic, accounting for 27.10% of cases, followed by inflammatory (lichen sclerosus) and iatrogenic with 25.25% each, and finally it was found 22.40% of this sample with idiopathic origin. Iatrogenic causes included a history of urethral injury due to urethral catheterisation, endoscopic resection of the prostate or bladder, and prolonged use of a Foley catheter (Table 2).

In 34.6% of cases the site of the stricture was at bulbar urethra, followed by penile urethra (24.5%). Panurethral involvement was seen in 13.4% and membranous urethra in 11.1%. Combined cases involving more than one segment and meatus or fossa naviculares each accounted for 5%. The mean length of the strictures managed by this center was 4.8 cm. Of the treated patients, 44.3% had cystostomy, and 32.8% had undergone previous urethral surgery. Mean operative time was 192 minutes and mean patient follow-up was 15.3 months.

In this series, there were 30 cases (17.2%) of recurrence in the first 6 months of follow-up after surgery. As shown in Table 3, when it was evaluated the learning curve based on recurrence, it was found no statistical difference in the first 174 cases, regardless of the variable evaluated.

Tab

Similarly, no difference in recurrence rates was found within the first 174 cases when we assessed the learning curve every 50 procedures, and there was also no statistically significant difference when comparing the recurrence rate each year.

When evaluated cases according to the level of complexity, both low and high complexity procedures were performed from the beginning of the learning curve (Graph 2). When we separated the recurrence rate according to the complexity of the surgery, we found that in Grade 1 complexity surgeries, we had a 12.34%

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3 recurrence, while in Grade 2 surgeries, recurrences were 21.5%, but without
4 statistical significance (Graph 3).
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7 **Discussion**

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12 Treatment of urethral strictures remains challenging and requires great
13 experience and skill. This is due to the fact that this condition manifests itself in
14 different ways, with varying degrees of complexity and several complicating
15 factors involved [14-18]. As a result, there is no single gold-standard technique, but
16 rather many approaches and various modifications of them, adapted to each
17 specific case. In this study, depending on the complexity of the case, it was
18 necessary to use different techniques, initially defined in the preoperative period.
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25 The main factors associated with increased difficulty and recurrence of
26 urethroplasties may be patient-related, smoking, diabetes, obesity, lichen
27 sclerosus, history of local radiation and previous surgery. In the same way, when
28 related to the procedure: surgeon's experience, technique used, length, etiology,
29 and location of strictures [1,2,5-8]. No single factor associated with a higher
30 incidence of recurrence was found to be statistically significant in our study.
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36 An inflammatory condition associated with urethral strictures, lichen
37 sclerosus increases the surgical complexity of urethroplasty.[19]. Patients with
38 smaller stricture length and lower incidence of lichen have been reported in
39 several studies with high success rates of urethroplasty [2,7]. In this study, it was
40 found a high rate of patients with lichen sclerosus and a mean length of
41 involvement of 4.8 cm. However, there was no statistical difference in the
42 recurrence rate.
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48 There is still controversy about the form of follow-up and the definition of
49 recurrence or failure [2,6-7]. Various forms have been described, both objective and
50 subjective [6]. It was used a subjective form based on the need to re-instrument
51 the urethra according to the patient's symptoms. This was the most practical way
52 to quantify this in our service [20]. In addition, the public and universal nature of
53 the Brazilian healthcare system means that asymptomatic patients have little
54 access to additional testing, leaving resources to diagnose symptomatic patients.
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3 In general, 5-35% of patients experience a recurrence when it was
4 analyzed the recurrence rates according to the different urethroplasty techniques
5 applied [1,6,9,18]. In this study, it was found a rate of 17.2% in the first 6 months of
6 follow-up. This is consistent with other studies reported in the literature.
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10 This study has several limitations. One is the assessment of strictures
11 recurrence in the short term, even though many studies show that strictures
12 occurs more frequently in the first follow-up [15,17]. Longer-term monitoring could
13 complement our analysis. Second, it was to define recurrence according to the
14 necessity for new urethral instrumentation, as described in other studies [6],
15 because uroflowmetry, flexible cystoscopy and imaging were not widely available
16 to all patients for follow-up. Thirdly, we evaluated a heterogeneous group in
17 which, due to the different complexity of each case, several techniques had to be
18 performed, without achieving progressive surgical training and potentially leaving
19 the learning curve longer to obtain statistical differences in recurrence rates.
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22 Typically, a urologist's training in urethral strictures is long. It can take
23 years to develop a variety of presentations. In our service, as a referral center,
24 high and low complexity cases are present from the beginning of the career, being
25 a greater number of cases is necessary to define the cut-off point of the learning
26 curve.
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29 30 31 32 33 34 35 36 37 38 39 40 **Conclusions**

41 Urethroplasty is a procedure with a long learning curve. This is due to the
42 wide variety and complexity of urethral strictures, as well as the large number of
43 techniques and their variations. The level of complexity of the procedure results
44 in higher recurrence rates, but a larger sample is required to establish the number
45 of low and high complexity procedures needed to complete the learning curve.
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48 49 50 51 **References**

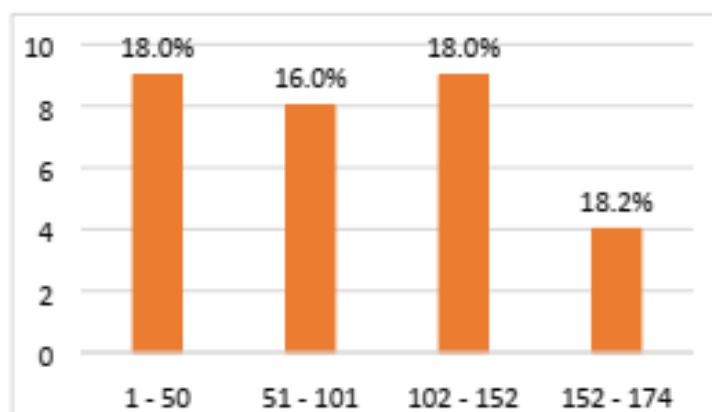
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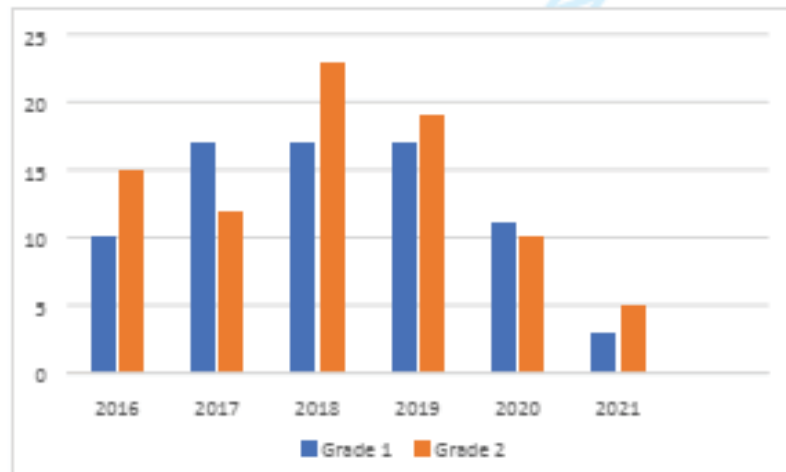
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13 Graphic 1. Recurrence rate of every 50 procedures



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32 Graphic 2 - Procedure according to complexity



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54 Graphic 3 - Recurrence according to complexity



Table 1. Descriptive characteristics of patients affected by urethral stricture.

Variables		Number of Patients (%)
Gender	Female	11 (6.4%)
	Male	161 (93.6%)
Ethnicity	White	133 (76.9%)
	Black	8 (4.6%)
	Brown	31 (17.9%)
	Asian	1 (0.6%)
HBP	Yes	82 (47.1%)
	No	92 (52.9%)
Diabetes	Yes	16 (9.2%)
	No	158 (90.8%)
Smoker	Yes	37 (21.3%)
	No	137 (78.7%)
Re-operation	Yes	57 (32.8%)
	No	117 (67.2%)
Cistostomy	Yes	77 (44.3%)
	No	97 (55.7%)

HBP- High Blood Pressure

Table 2. Causes of urethral stricture.

Cause	Number of Patients (%)
Post-traumatic	47 (27,10%)
Inflammatory	44 (25,25%)
Iatrogenic	44 (25,25%)
Idiopathic	39 (22,40%)

Table 3. Risk factors of recurrence at 6-month follow-up.

Variable	Recurrence		p-value
	Yes	No	

Gender	Female	1 (9.1%)	10	0.789
	Male	29 (18.0%)	132	
Age		51.7 (14.5)	53.3	0.602
Ethnicity	White	23 (17.3%)	110	0.937
	Black	1 (12.5%)	7	
	Asian	0	1	
	Brown	6 (19.4%)	25	
HBP	Yes	12 (14.6%)	70	0.427
	No	18 (19.6%)	74	
Diabetes	Yes	2 (12.5%)	14	1
	No	28 (17.7%)	130	
BMI		26.2 (3.4)	27	0.28
Smoker	Yes	6 (16.2%)	31	1
	No	24 (17.5%)	113	
Lichen	Yes	9 (20.0%)	36	0.647
	No	21 (16.3%)	108	
Re-operation	Yes	13 (22.8%)	44	0.202
	No	17 (14.5%)	100	
Cistostomy	Yes	11 (14.3%)	66	0.422
	No	19 (19.6%)	78	
IPSS		29.4 (8.2%)	30.6	0.522
QoL		3.6 (1.1%)	2.9	0.061
Follow-up (months)		12.9 (8.2%)	15.8	0.124

BMI – Body Mass Index / HPB – High Blood Pressure/ IPSS - International Prostate Symptom Score/ QoL - Quality of life

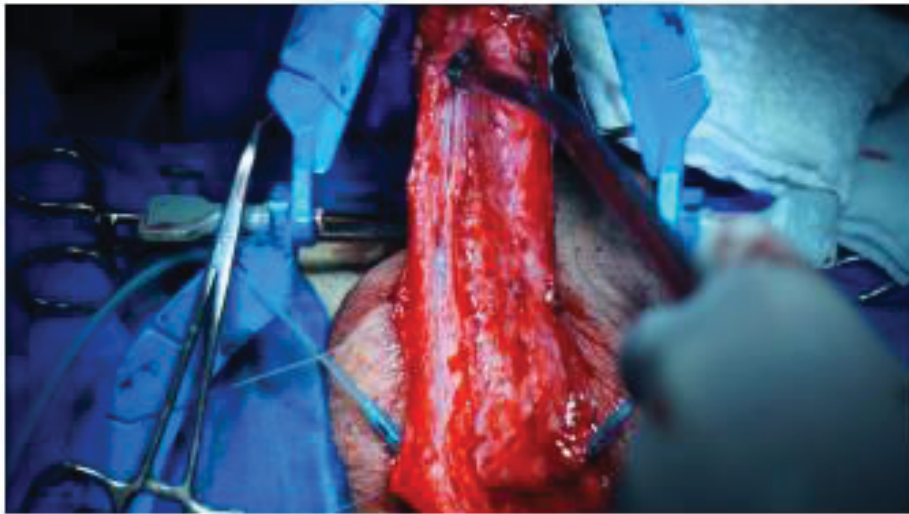
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Grade 1 - Perineal Urethrostomy

149x83mm (220 x 220 DPI)

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Grade 2 - Urethroplasty with oral mucosal graft greater than 3 cm

149x83mm (220 x 220 DPI)

5. CONCLUSÃO

A uretroplastia é um procedimento com uma longa curva de aprendizado. Isso se deve à ampla variedade e complexidade das estenoses uretrais, bem como ao grande número de técnicas e suas variações. O nível de complexidade do procedimento resulta em taxas de recorrência mais altas, mas é necessária uma amostra maior para estabelecer o número de procedimentos de baixa e alta complexidade necessários para concluir a curva de aprendizado

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Figura – 1 – Ureostomia Perineal

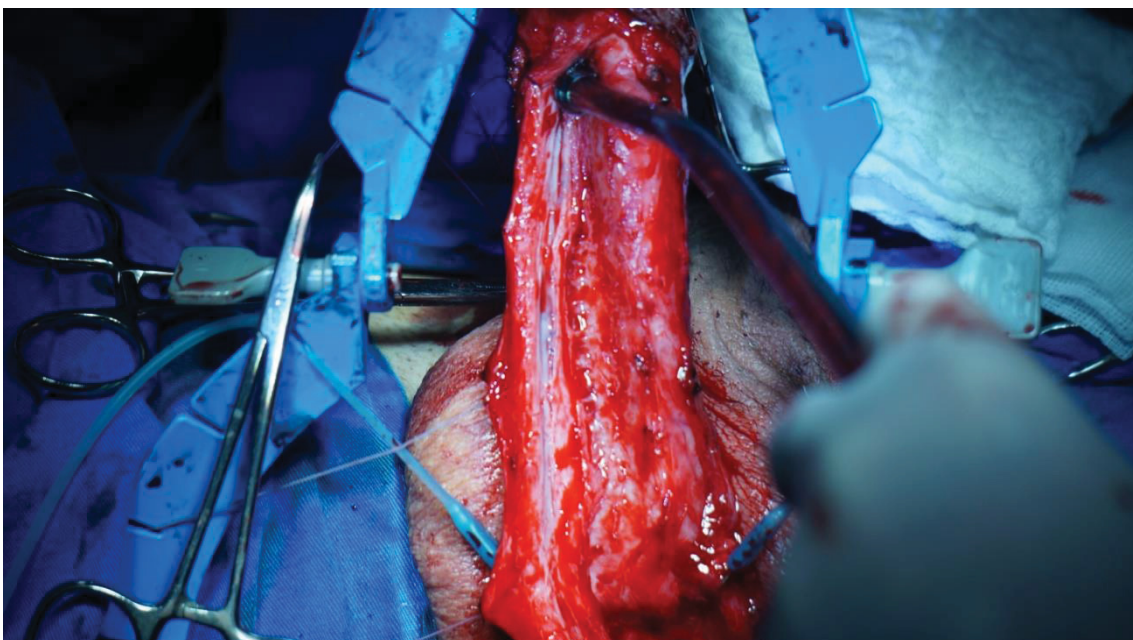


Figura 2 – Uretroplastia com enxerto de mucosa oral maior que 3 cm