Comparative evaluation of 90-day patient outcomes and healthcare encounters following extended day surgery urethroplasty

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ABSTRACT

Introduction: Most centers have shifted to an extended day surgery (XDS) model for urethroplasty. Our study characterizes outcomes and unplanned healthcare encounters of patients undergoing XDS urethroplasty compared to case-matched inpatient controls.
Methods: We conducted a retrospective, two-surgeon, single-center study of patients undergoing XDS urethroplasty (discharge <24 hrs) from November 2020 to November 2021. Patients were case-control matched based on age, stricture length, location, and etiology to patients who had previously undergone inpatient urethroplasty. Data was analyzed using descriptive and univariable statistics. Multivariable analysis by Cox proportional hazard regression was used to identify associations with postoperative complications.
Results: Ninety patients (mean age=53.8 years) underwent XDS urethroplasty during the study period. Mean stricture length was 4.4 cm

KEY MESSAGES

- Rates of 90-day postoperative complications for patients undergoing extended day surgery (XDS) urethroplasty are similar to patients admitted to hospital postoperatively
- Patients with penile urethral strictures were shown to have an increased risk of developing a post-operative complication on multivariate analysis.
- Frequency of clinic phone calls and ED visits are similar within the postoperative period; however, patients presenting to the ED are more likely to have a true complication.
- XDS urethroplasty is a safe and effective treatment option for urethral strictures within a publicly funded healthcare model.
- Implementation of pre-emptive patient outreach and education within two weeks of surgery may decrease numbers of unplanned and avoidable healthcare interactions.

standard deviation [SD] 2.4). Rates of postoperative complications were similar between XDS (17%, n=15) and admitted patients (21%, n=19), and XDS was not associated with increased risk on univariable analysis (odds ratio [OR] 0.65, 95% confidence interval [CI] 0.31–1.3, p=0.36). When stratifying by location, penile stricture (OR 4.21, 95% CI 1.3–13.8, p=0.02), and lichen sclerosus (OR 2.91, 95% CI 0.79–9.9, p=0.08) were associated with increased risk of postoperative complication. On multivariable analysis, only penile stricture was identified as significant (OR 4.78, 95% CI 1.2–19.4, p=0.03). Forty-eight percent (n=43) of patients had unplanned healthcare encounters postoperatively, with similar numbers of phone calls (n=37) and emergency department visits (n=36) between groups.
Conclusions: Our study shows that XDS urethroplasty is not associated with increased rates of complications relative to inpatient admission. This data supports using an XDS pathway for resource-efficient treatment of urethral strictures in a universal healthcare setting.

INTRODUCTION

Urethral stricture disease (USD) is a condition caused by fibrosis and narrowing of the urethral lumen, manifesting primarily as symptoms of lower urinary tract obstruction and recurrent urinary tract infections that can significantly impact patient quality of life.[1] Endoscopic treatment is commonly utilized as a first-line treatment option for USD. However, these techniques have been shown to be associated with high rates of recurrence ranging from 23 to 92% .[2] Additionally, repeated endoscopic treatments can predispose patients to longer and more complex strictures that can complicate future urethral reconstructions.[3] Urethroplasty is considered the gold standard treatment for USD due to comparatively lower rates of disease recurrence compared to endoscopic treatments, and improved patient outcomes.[4]

Progress in pre- and post-operative management of urethroplasty cases has allowed for the implementation of same-day or outpatient surgery. This approach is commonly defined as discharge within 24 hours of surgery and has previously demonstrated comparable safety and success outcomes to traditional inpatient procedures, primarily within privately-funded healthcare models.[5,6] Despite the demonstrated benefits, there are few centers offering same-day urethroplasty surgery within Canada, resulting in a significant lack of data on this pathway within a universal healthcare system.

The COVID-19 pandemic resulted in significant restrictions on the number of post-operative admissions and types of procedures that could be offered at most centers. In response to this, extended day surgery (XDS) urethroplasty was implemented at our tertiary care center to address the surgical backlog that had developed as a result of these restrictions. The aim of our study was to evaluate the overall safety of this approach in comparison to our current standard of care. We sought to analyze patient outcomes following XDS urethroplasty, by assessing 90-day

post-operative complications and healthcare utilization. We hypothesize that the outcomes of XDS and inpatient surgery will not differ.

METHODS

We conducted a retrospective single-center study of all patients undergoing urethroplasty surgery from November 2020 to November 2021. All adult patients (≥18 years) undergoing urethroplasty at the University of Alberta Hospital and who were discharged within a <24-hour timeframe were included in the study. Electronic medical charts were reviewed to extract data. The University of Alberta Research Ethics Board granted ethics approval (Pro00107205).

Patient age, comorbidities (as per Charlson Comorbidity Index), stricture characteristics (etiology, location, length), previous intervention history (endoscopic and surgical interventions), post-operative healthcare encounters, and complications were collected. Patients were then individually case control matched based on age, stricture length, and stricture etiology to patients who previously underwent urethroplasty requiring inpatient admission post-operatively. Controls were retrieved from a prospectively maintained database of all urethral reconstructions performed at the University of Alberta Hospital between 2003 and 2019.

Comparative analysis between study cohorts was conducted using Mann-Whitney *U* test for nonnormally distributed continuous variables and Fisher's exact test for categorical variables. Univariate logistic regression was used to identify variables associated with 90-day post-operative complications, and predictors with a *P*-value < 0.3 were included in the multivariate regression analysis. Multivariate analysis was conducted by Cox proportional hazard regression with time-to-event defined within 90 days following discharge. Categorical variables included age ≥50, stricture length ≥4cm, CCI score >1, BMI ≥35, history of genitourinary surgery, comorbidity burden, stricture location, and stricture etiology; and were selected based on previously identified clinically significant variables. All statistical tests were carried out as 2-sided analyses with a *P*-value <0.05 used to denote statistical significance. All analyses were completed on GraphPad Prism V9.3.

RESULTS

In total, 90 patients underwent XDS urethroplasty during the study period. Subsequent case-control matching with 90 admitted patients led to the inclusion of 180 patients in total. Baseline patient characteristics of the two cohorts were similar between both study cohorts and are outlined in Table 1. The most common stricture etiology was idiopathic (48%), followed by lichen sclerosus (18%) and iatrogenic (10%). 81% of strictures were located in the anterior urethra, with bulbar urethra being the most commonly observed location for stricture development (60%). Distribution of stricture etiology and location, and number of patients with previous endoscopic intervention and urethroplasty surgery were not significantly different between study cohorts. More patients within the XDS cohort had previously undergone other genitourinary surgery compared to admitted patients (11% vs 3%, p=0.04).

Rates of postoperative complications were similar between XDS and admitted patients (17% vs 21%, p=0.35) (Table 2). 53% (n=8) of complications in the XDS group were classified as clinically significant (Clavien-Dindo Grade ≥II), compared to 65% (n=13) in the admitted group. Post-operative infections requiring antibiotic therapy were the most commonly reported clinically significant complication. When compared to admitted patients, XDS urethroplasty was not associated with increased risk of 90-day post-operative complications (OR=0.65; 95% CI 0.31 to 1.3; p=0.26) (Table 3). Strictures within the penile urethra (OR=4.21; 95% CI 1.3 to 13.8; p=0.02), and lichen sclerosus etiology (OR=2.91; 95% CI 0.79 to 9.9; p=0.08) were associated with development of complications within 90 days on regression analysis. Stricture length, age, comorbidities, previous interventions, and BMI were not associated with post-operative complications. On multivariate analysis, only penile stricture location was identified as a significant predictor of 90-day complication.

Overall, 47% of patients (n=43) had documented unplanned healthcare interactions within 90 days of discharge resulting in 75 unplanned encounters (Table 4). Of these patients, 37% (n=16) had ≥2 interactions within 90 days, and 19% (n=8) presented with multiple types of healthcare interactions. More patients contacted the clinic by phone (n=26) than presented to the emergency department (ED) (n=22). However, the total number of events were similar between the two groups (n=37 vs n=36). Wound care questions were the most common reason for clinic phone calls (43%, n=16), whereas foley catheter issues were the most common reason for ED presentation (42%, n=15). Of patients who presented by phone, 8% (n=3) experienced a post-operative complication, while the rest were managed with reassurance. 28% (n=8) of patients presenting to ED experienced a post-operative complication. Only 2 patients had unplanned clinic visits, both of which had a post-operative complication (catheter blockage and infection). Time to presentation was similar for all interaction types, with an average of 13.9 days for phone calls, 13.1 days for ED visits, and 14 days for clinic visits.

DISCUSSION

This is the first study to evaluate XDS urethroplasty at a Canadian centre. Our data shows that XDS is a safe and effective option for the management of urethral strictures. There were comparable rates of 90-day complications between XDS and admitted patients when controlling for key patient factors, corroborating previous studies from other centers.[6,7] Of these patients, presence of a penile stricture and underlying inflammatory etiology were associated with increased odds of developing a post-operative complication. Furthermore, during the 90-day post-operative period 48% of patients undergoing XDS had unplanned healthcare interactions, with a similar number of phone calls and ED visits.

Previous studies have identified inflammatory strictures as a risk factors for urethroplasty failure; specifically, the presence of lichen sclerosus portends a poorer prognosis overall, and has been clearly identified as an independent predictor of stricture recurrence.[8,9] While the exact mechanism remains unclear, it is thought that chronic localized inflammation leads to alterations

in cellular differentiation and proliferation resulting in a pro-fibrotic environment that favours stricture recurrence.[10] Furthermore, variations in VEGF expression have also been reported in lichen sclerosus patients, impairing wound healing through decreased oxygen and nutrient delivery to the urethral plate following surgical repair.[11] Additionally, penile strictures have been associated with increased risk of stricture recurrence as well as complications in patients awaiting urethroplasty.[12] This is thought to be due to the high correlation of penile strictures with lichen sclerosus which results in longer, more complicated strictures, as well as poorer vascularization in comparison to other urethral segments.[13] While the majority of studies have focused on long-term outcomes, a more recent report has demonstrated that rates of 90-day complications following urethroplasty were increased in patients with strictures caused by lichen sclerosus, but not in those with penile strictures [14]. We found that strictures within the penile urethra and those caused by lichen sclerosus were associated with developing a post-operative complication on univariate analysis, however only penile location was shown to be significant on multivariate analysis. Our results suggest that disease mechanisms predisposing patients to stricture recurrence following urethroplasty may be occurring early in the post-operative course leading to shorter-term complications. Further studies evaluating the association between short-term complications and stricture recurrence may be useful in stratifying risk of future complications and help to identify patients in need of increased monitoring.

When controlling for key patient characteristics between cohorts, XDS was shown to reduce hospital length-of-stay with no significant impact on short-term post-operative outcomes. A median wait time of 151 days for definitive urethroplasty was previously reported for our center, which is much longer than comparable American centers.[12] The advent of the COVID-19 pandemic fundamentally altered the delivery of health services in Canada, further exacerbating this pre-existing problem. Reductions in surgical volume have been reported by centers across the country as a result of pandemic restrictions, resulting in significant increases in wait times for elective and nonemergent procedures.[15] Average wait times for definitive urethroplasty in Quebec have increased 68% to a median of 557 days.[16] These effects are not specific to Canada, with centers across the world experiencing similar delays for urologic procedures.[17,18] Despite widespread implementation of vaccines and easing of restrictions, there has been a slow transition back to baseline volumes. A retrospective time-series analysis of all surgical procedures conducted at a similarly sized tertiary care center in America found that urologic surgeries have only returned to 85% of pre-pandemic levels.[19] Deferral of surgical treatment is associated with significant risks ranging from deterioration in mental health and quality of life, to disease progression and increased rates of mortality.[20] Addressing backlogs is therefore crucial for minimizing patient morbidity and improving health outcomes.

Modelling studies have been utilized to better quantify these delays, and estimate time and resources required to clear surgical backlogs. A study conducted in late 2020 estimated it would take 84 weeks to address surgical backlogs in Canada with ideal allocation of resources

such as increased OR time, and ward/ICU beds.[21] However, this model did not account for recurrent waves and reimplementation of restrictions ultimately resulting in continued delays in accessing timely public surgical care. While more stringent policies and restrictions to reduce the spread of COVID-19 and streamline access to emergent surgeries, they significantly delay access to elective procedures.[22] Novel approaches to clearing these backlogs have emerged as a result, specifically shifting to outpatient procedures where possible to maintain surgical volume while decreasing healthcare utilization. Transition to ambulatory percutaneous nephrolithotripsy was previously reported to significantly decrease length of hospitalization with no impact on short term outcomes, while additionally saving approximately $5327 per case.[23] Similar findings have been reported for robotic pelvic floor reconstruction, where transition to outpatient procedures has decreased length of stay and associated healthcare costs.[24] Canadian centers that have implemented outpatient surgeries in lieu of inpatient surgeries have demonstrated comparable outcomes while increasing volume and patient satisfaction.[25]

An essential aspect of implementing XDS at our center involved creating a clearly defined pathway that focused on staff and patient education, maintenance of analgesia, and definitive follow-up plan. Post-operative healthcare encounters are an important metric to analyze in this setting, as frequent presentations lead to increased healthcare utilization. Inappropriate analgesia and hemorrhage are the most common reasons for ED presentations following outpatient surgery, and urologic surgery has been identified with increased rates of post-operative presentations.[26] When specifically looking at reasons for representation to healthcare in urologic patients hematuria, urinary retention, and urinary tract infections are the most common presenting complaints.[27] We found an overall healthcare encounter rate of 48% in our study, similar to what has been previously reported for ambulatory urethroplasty.[6] However, when looking at true rate of complications only 28% of patients presenting to ED experienced complications requiring intervention, meaning that the majority of these visits were avoidable. Interestingly, time to ED presentation and phone call to clinic were similar which could indicate a window of time in which pre-emptive intervention could be implemented to reduce unnecessary ED presentations. One reason for the high rate of unnecessary visits may be due to patient anxiety about inadequate healing, and interpretation of normal post-operative course as more serious signs of underlying complications.[28] Pre-emptive interventions such as multimedia communication and contact by specialized clinical nurse educators have been shown to be effective in reducing the rates of unnecessary ED presentations.[29,30] Further implementation of these strategies in the context of expedited patient discharge may be additive in reducing overall healthcare utilization and expenditures and have the additional benefit of increasing patient satisfaction and perceived quality-of-life in the post-operative period.

There are several limitations to our current study. First, this is a single-center retrospective review which limits wider extrapolation of our findings. Second, we evaluated a surgical pathway which had been recently implemented at our center. This ultimately resulted in

a relatively small sample size with limited time to follow-up. We tried to address this through comparative case-control matching to maximize the internal validity of the study using a larger patient pool over an extended period of time.

CONCLUSIONS

XDS urethroplasty is a highly effective treatment option for USD and is not associated with increased rates of 90-day post-operative complications compared to inpatient urethroplasties. Presence of a penile stricture increased risk of developing a 90-day post-operative complication on multivariate analysis. Overall, our findings demonstrate that <24-hour discharge following urethroplasty is both feasible and safe within the Canadian context. Future studies evaluating long-term outcomes of XDS urethroplasty patients will provide further insight into the comparative efficacy of this protocol relative to the current standards of care.

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FIGURES AND TABLES

Table 1. Patient and stricture characteristics for XDS and Admit patients

	XDS (n=90)	Admit (n=90)	p
Mean age, yr (SD)	53.8 (15.6)	53.5 (15.6)	0.88
Mean stricture length, cm (SD)	4.36 (2.41)	4.41 (2.85)	0.50
CCI Score (SD)	1.01 (1.47)	0.70 (1.05)	0.22
Stricture etiology (%)			
Idiopathic	48 (53)	48 (53)	1.0
Lichen sclerosis	16 (18)	14 (16)	0.69
Iatrogenic	9 (10)	13 (14)	0.36
Radiation	7 (8)	7 (8)	1.0
Hypospadias	5 (6)	4 (4)	0.73
Trauma	5 (6)	4 (4)	0.73
Stricture location (%)			
Bulbar	54 (60)	53 (59)	0.88
Penile	23 (26)	20 (22)	0.60
Posterior	9 (10)	12 (13)	0.48
Panurethral	4 (4)	5 (6)	0.73
Previous interventions (%)			
Endoscopic procedures			
0	11(12)	15 (17)	0.40
1–2	48 (53)	45 (50)	0.45
>2	31 (34)	30 (33)	0.87
Surgical procedures			
Urethroplasty	10 (11)	8 (9)	0.62
Other GU surgery	10 (11)	3 (3)	0.04

CCI: Charleson Comorbidity Index; GU: genitourinary; SD: standard deviation; XDS: extended day surgery.

Table 2. Classification of post-operative complications using Clavien-Dindo grading system.			
	CD classification	**Number (%)**	**Complication**
XDS (17%)	Grade I	7 (8)	Catheter related (3)
			Wound dehiscence (2)
			Hematuria (2)
	Grade II	7 (8)	Surgical site infection (3)
			UTI (3)
			Epididymitis (1)
	Grade III	1 (1)	Abscess requiring debridement (1)
Admit (21%)	Grade I	6 (7)	Wound dehiscence (4)
			Catheter related (1)
			Hematuria (1)
	Grade II	9 (10)	UTI (5)
			Wound related (2)
			Epididymitis (1)
			Surgical site infection (1)
	Grade III	4 (4)	Fistula requiring closure (3)
			Cystoscopic catheter reinsertion (1)

CD: Clavien-Dindo; UTI: urinary tracti; XDS: extended day surgery.

Table 3. Univariate and multivariate analysis of factors associated with 90-day postoperative complications			
Univariate analysis			
Variable	**OR**	**95% CI**	**p**
Age ≥50 yrs	0.58	0.19–1.8	0.34
Stricture length ≥4 cm	0.61	0.46–2.0	0.24
CCI >1	0.85	0.26–2.6	0.78
Previous surgery	0.45	0.38–1.9	0.23
Previous endoscopy (>2)	0.63	0.16–2.1	0.47
BMI ≥35	1.46	0.37–4.9	0.29
Stricture location			
Bulbar	0.52	0.17–1.6	0.35
Penile	4.21	1.3–13.8	0.02
Panurethral	1.71	0.48–14.5	0.27
Stricture etiology			
Idiopathic	1.38	0.45–4.5	0.57
Lichen sclerosus	2.91	0.79–9.9	0.08
Radiation	0.82	0.04–5.4	0.86
XDS surgical pathway	0.65	0.31–1.3	0.36
Multivariate analysis			
Variable	**HR**	**95% CI**	**p**
Penile stricture	4.78	1.2–19.4	0.03
Panurethral stricture	7.79	0.32–89.9	0.12
Lichen sclerosus	0.75	0.16–3.2	0.70
Stricture length >4 cm	0.60	0.14–1.9	0.44
Previous surgery	0.34	0.04–1.7	0.22
BMI ≥35	0.90	0.21–3.1	0.87

BMI: body mass index; CCI: Charleson Comorbidity Index; CI: confidence interval; HR: hazard ratio; OR: odds ratio; XDS: extended day surgery.

Table 4. Healthcare encounters and complication rate in 90-day post-operative period.					
Type	**Patients (n=43)**	**Events (n=75)**	**Mean days to contact (SD)**	**Reason for interaction**	**Complication rate (n)**
Phone call	26	37	13.9 (10.4)	Wound care (16)	8% (3)
				Foley care (8)	
				Pain (8)	
				Other (5)	
Emergency department	22	36	13.1 (6.22)	Foley dysfunction (15)	28% (10)
				UTI (3)	
				Surgical site infection (2)	
				Epididymitis (1)	
				Bleeding (6)	
				Pain (5)	
				Other (4)	
Unplanned clinic	2	2	14.0 (2.82)	Catheter blockage (1)	100% (2)
				Penoscrotal abscess (1)	

Complication rate: total number of reported complications per encounter type divided by total number of encounter type events; SD: standard deviation; UTI: urinary tract infection.