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Minor procedure, major impact: patient-reported outcomes following urethral meatotomy

Briony K Varda, MD*, Tanya Logvinenko, Stuart Bauer, Bartley Cilento, Richard Yu, and Caleb P Nelson

Boston Children's Hospital, Boston, MA, USA

Summary

Introduction—Urethral meatotomy as treatment for meatal stenosis is a common pediatric urology procedure; however, little is known about the patient experience following this procedure.

Objective—We aim to evaluate clinical factors associated with patient-reported symptom improvement after urethral meatotomy.

Study design—The families of boys undergoing urethral meatotomy between 2/2013 and 8/2016 received a survey by mail 6 weeks after surgery. Families were queried on changes in symptoms using a Likert-type scale (5 = much improved, 4 = somewhat improved, 3 = no change, 2 = somewhat worse, and 1 = much worse). Patient and procedure characteristics of the respondents were obtained via chart review. These included surgical indication(s) (abnormal stream, dysuria, or storage symptoms), postoperative complications, reoperation, and unplanned postoperative communications. Patients who had procedures other than simple urethral meatotomy were excluded. Descriptive statistics were compiled, and generalized estimating equations used to determine the associations of patient and procedure characteristics with symptom improvement.

Results—We sent 629 surveys and received 194 responses (30.4%). Twelve respondents were excluded for complex procedures or miscoding. The majority of respondents were privately insured (74%) and were between 5 and 12 years old (45%) or 1 and 4 years old (42%). The most frequent surgical indication was abnormal stream (72%) followed by pain (21%) and storage symptoms (15.5%). Nine respondents had minor complications (4.9%). Four patients had restenosis requiring repeat urethral meatotomy. After surgery, a majority (79%) were “much improved,” 16% were “somewhat improved,” 3% had “no change,” and 1% were “somewhat worse.” No family reported “much worse.” Those patients who had “abnormal stream” as a surgical indication were significantly more likely to report “much improved” (OR 1.83, $p=0.014$)

*Corresponding author. Boston Children's Hospital, Department of Urology, 300 Longwood Avenue, Hunnewell 390, Boston, MA 02115, USA. Fax: 617-730-0474, Phone: 612-578-9877, briony.varda@childrens.harvard.edu.

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Approval

This project was approved by Boston Children's Hospital institutional review board

Conflict of interest

None.

than those without (Table). Patient-reported improvement was not associated with suture use, patient age, insurance, surgeon, or location of the procedure.

Discussion—Little has been written about patient-reported outcomes following urethral meatotomy. Our study affirms that the majority of boys improve following this procedure. However, improvement is significantly more likely if the child has a preoperative indication of an abnormal stream, such as deflection or spraying. Boys with symptoms of dysuria, frequency, or incontinence may be experiencing sequelae of meatal stenosis that simply take longer to improve. Alternatively, the meatal stenosis may be incidental to the primary symptoms.

Conclusions—A majority of families report substantial symptomatic improvement after urethral meatotomy. However, boys undergoing urethral meatotomy for reasons other than a urinary stream abnormality are less likely to experience improvement.

Keywords

Meatotomy; Patient-reported outcomes

Introduction

Meatal stenosis is a narrowing of the urethral meatus that largely occurs in circumcised boys, many of whom become symptomatic [1,2,3]. These symptoms may include a deflected urinary stream, spraying of urine during voiding, dysuria, or storage-related lower urinary tract symptoms (e.g. urinary frequency, urgency, nocturia, and incontinence). In a study by Cubillos *et al.*, 15 of 20 patients with meatal stenosis undergoing uroflometry had either a staccato or prolonged voiding pattern [4].

Many patients with meatal stenosis will undergo urethral meatotomy [5], which entails sharply incising the stenotic skin flap covering the meatus. Following this, some surgeons will evert the urethral mucosa using interrupted tacking sutures and others will not [5–7]. Regardless of approach, the procedure is typically short and is associated with low rates of restenosis (approximately 0–1.8%) [4–7]. Although urethral meatotomy is a “minor” procedure, its high frequency in pediatric urology practice makes it a potentially impactful topic for outcome assessment.

No validated, disease-specific patient-reported outcome measures exist for urethral meatotomy, but informal assessments suggest that 13–21% of patients do not experience complete resolution of symptoms following the procedure [4,8]. As part of a quality improvement initiative within our institution, we developed a questionnaire to examine the patient experience during and after a urethral meatotomy, including patient-reported outcomes. The primary objective of this study was to evaluate rates of patient-reported improvement after urethral meatotomy, as well as variables associated with lower improvement scores. Of secondary interest was the effect of procedure technique (suture versus no suture) on clinical and patient-reported outcomes.

Methods

Survey design, sample, and administration

A postoperative urethral meatotomy survey was created for the purposes of tracking quality within our department. The initial questions were developed by content experts and subsequently revised by consensus among 11 staff urologists. The survey included nine questions. The first two questions asked for the age category of the patient (<1 year old, 1–4 years old, 5–12 years old, >13 years old) and whether or not an additional procedure was performed at the time of urethral meatotomy. Questions 3–8 used Likert-type scales, with questions 3–5 focused on communication, including how courteous the care team was, how well informed the respondent felt about the procedure, and how satisfied the patient and/or family were with postoperative instructions. Question 6 asked about pain control after surgery, and question 7 focused on postoperative symptoms compared with preoperative status (5 = much improved, 4 = somewhat improved, 3 = no change, 2 = somewhat worse, and 1 = much worse). If respondents indicated improvement they were then asked in what areas (better aim, decreased spray, less pain, stronger stream, less frequent urination or accidents). The final question asked for comments on how to improve the experience.

All patients who underwent a urethral meatotomy at our institution between 2/1/2013 and 6/1/2016 were sent a survey via mail 6 weeks after their procedure, along with a cover letter and a stamped, addressed envelope. Survey results were returned to our quality improvement coordinator who then recorded the results into our quality improvement database. We did not provide an incentive for returning the survey. In most cases, parents or legal guardians responded, acting as proxies for their sons who underwent urethral meatotomy.

Additional variables

Patient, procedure, and outcome information was abstracted from retrospective chart review. Patient information included insurance type (private or public) and preoperative indication (abnormal stream, dysuria, and bladder storage symptoms (e.g. urinary frequency, urgency, nocturia, and incontinence)). If a uroflow study was performed preoperatively the following parameters were recorded: maximum flow rate, voided volume, post-void residual, and the shape of the flow curve; indications for a uroflow study were at the discretion of the provider. Flow curves were interpreted in a manner similar to that recommended by the International Children's Continence Society [13]. Procedure information included where it was performed (main or satellite hospital) and whether or not sutures were used (based on operative notes). Clinical outcomes included complications and reoperations, as well as unprompted communications the family had with the Urology Department postoperatively. Patient follow-up depended on surgeon preference, with some surgeons offering "as needed" postoperative visits. Patients with no follow-up communications were classified as having no complications. An event was considered to be a complication if it deviated from the typical postoperative course following urethral meatotomy, including anything that required additional visits, phone calls, procedures, or undue distress to the family. An unprompted communication was defined as any emails, phone calls, or requests for a visit initiated by the family in the postoperative period. Procedures in patients with complex underlying conditions (e.g. prior hypospadias repair or urethral duplication) were excluded.

Surgical procedure

All urethral meatotomies were performed in the operating room under sedation or monitored anesthesia care with either EMLA cream or a local ring/penile block. One of two surgical techniques were used: urethral meatotomy alone or urethral meatotomy with suture eversion of the urethral mucosa. Techniques varied based on individual surgeon preference. Postoperatively, all patients were given bacitracin and advised to apply it liberally two to three times daily during the healing process. Instructions for the alternating use of acetaminophen and ibuprofen were given to the families. In rare instances, oxycodone was prescribed.

Statistical analysis

Descriptive statistics were used to summarize the cohort of responders. To lessen ceiling effects, Likert-type scales were collapsed into binary variables for questions 3–8. The main outcome was patient-reported symptom improvement, which was dichotomized into those in the highest category (“much improved”) and those who reported lower scores (“somewhat improved,” “no change,” “worse,” or “much worse”). Generalized estimating equations with logit link were used to determine associations between symptom improvement and patient- and procedure-specific characteristics while accounting for surgeon clustering. A sub-group analysis of suture use was performed using generalized estimating equations for group comparisons and Firth-penalized likelihood for reoperation. All analyses were performed using SAS v9.4 (SAS Institute Inc., Cary, NC, USA).

Approval

This project was approved by Boston Children’s Hospital institutional review board.

Results

During the 40-month study period, 629 urethral meatotomies were performed (average 16 cases/month). Quality improvement surveys were mailed to all families and 194 responded (30.8%). Ten (of 13 possible) surgeons had patients who returned surveys, with the proportion of responses for an individual surgeon ranging from 2.2% to 22%. Eleven patients were excluded for having had a procedure with greater complexity than a simple urethral meatotomy, including prior hypospadias repair, urethral duplication, a reoperative urethral meatotomy, and a meatal advancement procedure. One patient was excluded for miscoding, leaving a total of 182 participants. The majority of patients with stream abnormalities were categorized as 1–12 years old. However, three patients younger than 1 year had a reported stream abnormality in the context of additional complaints of penile redness and/or an appearance of discomfort with voiding. Table 1 summarizes patient and procedure characteristics.

Only 15 patients (8.2%) underwent uroflow studies preoperatively. Among those, only two had normal-appearing bell-shaped curves, while 13 demonstrated plateau curves. The median maximum flow rate was 12.1 mL/s (range 4.6–24 mL/s) with a median voided volume of 169 mL (range 79–553 mL). Post-void residuals were low (between 0 and 42 mL).

With regards to improvement, a majority (79%) were “much improved,” 16% were “somewhat improved,” 3% had “no change,” and 1% were “somewhat worse.” No patients reported being “much worse.” Sixty-four percent of patients had in-office postoperative visits with no difference in the rate of visits between those reporting improvement and those not (71% vs. 62%, $p=0.24$). Among the full cohort of respondents, nine complications occurred (4.9%). These complications included two suture granulomas, two ulcerations of the meatus, one fungal skin infection, and recurrent stenosis leading to reoperation in four patients (2.2%). There were no major complications. Unprompted communications were made by 14% of families. Postoperative outcomes stratified by patient-reported improvement are reported in Table 2.

After adjusting for surgeon clustering, patients with a stream abnormality were significantly more likely to report improvement than patients with other preoperative indications (OR 1.82, 95% CI 1.12–2.94, $p = 0.014$). In addition, patients who had a complication and/or required reoperation were significantly less likely to report improvement (OR 0.19, 95% CI 0.05–0.77, $p = 0.02$; OR 0.08, 95% CI 0.01–0.65, $p = 0.018$, respectively). There was no difference in reported improvement for age category, insurance type, suture use, unprompted communication, additional procedures, location of the surgery, or postoperative pain control.

A sub-group analysis investigating the relationship between suture use and clinical outcomes is reported in Table 3. In summary, there was no statistical difference in outcomes after urethral meatotomy with or without suture. Of note, a smaller proportion of sutured patients had in-person follow up (57% vs. 80%, $p=0.067$).

Discussion

In this postoperative patient-reported outcomes survey study, we found that a large majority (79%) of families reported significant improvement after urethral meatotomy for meatal stenosis. Boys with stream-related symptoms were significantly more likely to experience improvement compared with those with dysuria and bladder storage symptoms. Use or non-use of suture during the procedure was not associated with symptom improvement. This is the first study to systematically assess patient outcomes after urethral meatotomy. Although urodynamic parameters such as flow rate may be the most objective way to measure stream improvement after urethral meatotomy, it is unrealistic to obtain them in all patients. Thus, assessing improvement from a patient’s perspective is a valuable alternative to measuring outcomes following urethral meatotomy.

In this study we found that boys with an abnormal stream, including spraying or a deflected stream, were significantly more likely to experience improvement after urethral meatotomy than those with storage symptoms, such as frequency, urgency, and incontinence. One possible explanation for this is that meatal stenosis leads to chronic changes in lower urinary tract function, which may take longer to resolve than the follow-up period of this study. Such changes may also be incompletely addressed by this surgery. Alternatively, there may be a detection bias in which patients presenting with lower urinary tract symptoms are noted to have meatal stenosis, yet the stenosis is not the true source of the symptoms; correcting the stenosis, therefore, would not be expected to result in symptom resolution. The rate of

asymptomatic meatal stenosis in circumcised males has been estimated at 2.8–20.4%, and increases with age [2,9]. Conversely, among males with known meatal stenosis, up to one-third may be asymptomatic [3,10]. Thus it seems plausible, given the relatively high prevalence of asymptomatic meatal stenosis, some cases may be identified during a genitourinary exam performed for unrelated urinary complaints.

We found that 7% of boys reported moderate to severe pain following urethral meatotomy. A number of groups have investigated pain control during and after urethral meatotomy. Two single-institution case series reported lower rates of pain (3.1% and 5.2%) while undergoing urethral meatotomy with topical anesthesia [6,7], but a third study reported 22% of patients had pain during urethral meatotomy [8]. Ben-Meir *et al.* performed a randomized controlled trial specifically evaluating the effect of three types of anesthesia on pain levels after urethral meatotomy [11]. They found that 26% of all patients report some degree of pain at discharge, of whom 42% had moderate to severe pain. Furthermore, 17% of all patients reported residual pain at home the following day. While these findings regarding pain are mixed and certainly some postoperative pain can be expected, patients may experience more pain following urethral meatotomy than is commonly appreciated. This has raised our awareness about evaluating postoperative pain and providing adequate pain control in this patient population.

The rate of unprompted postoperative communication did not appear to be associated with symptom improvement. However, contacts were more common among boys who had sutures placed (15% vs. 9.8%). One explanation is that the mere presence of sutures adds an additional visible factor about which parents might worry. Some believe use of sutures causes undue discomfort in the child, as well as concerning postoperative appearance and spraying of urine [4]. Consistent with the latter concept, two of our complications resulted from retained sutures and both boys had unprompted communication with our office. However, another explanation for a higher rate of unprompted communication in the suture group is that one of the busier surgeons in the “suture” group does not routinely see his patients back after urethral meatotomy; thus, fewer families in this group completed in-person follow-up visits, which may have prompted more unplanned contacts among this group.

Overall, complications and reoperation were uncommon in our cohort of responders. We experienced a complication rate of 4.9%, which is similar to that reported in three prior studies (0–6.6%) [4,11,12]. Restenosis was uncommon (2.2%). Not surprisingly these boys were significantly more likely to report a lack of improvement (a finding that provides construct validity for this survey item). Similarly, four small single-center studies also reported low restenosis rates (0–1.8%) [5–8,12], while a large multicenter study of 4,373 urethral meatotomy patients also reported a low overall reoperation rate (1.6%) [5].

Suture use during urethral meatotomy is significant because it may determine whether the procedure can be performed in the clinic with topical anesthesia versus the operating room under anesthesia or sedation. In our sub-group analysis, we compared outcomes with and without suture and found no statistically significant differences. With all outcomes being equal, one could argue that the benefits of suture-less urethral meatotomy – avoidance of

anesthesia and time saved by the family and provider – make it the preferable approach. However, the largest study published on urethral meatotomy ($n = 4,373$) found that reoperation was more common in the suture-less group (8.7-fold higher odds of reoperation compared with a sutured group) [5]. A clinical trial comparing the two surgical approaches would best address the debate of whether or not to use suture.

The results of our study should be interpreted in light of its limitations. First, our clinical variables relied on retrospectively collected data, which may be inherently biased or missing information. This also means that our follow-up period was restricted to that of each surgeon's typical practice; therefore, we were unable to assess long-term outcomes. Second, we did not use a validated questionnaire, as no urethral meatotomy-specific instrument exists. We did reach departmental consensus on the instrument and used dichotomization to carefully re-categorize our data to report meaningful clinical outcomes and mitigate ceiling effects. Although we may have increased recall bias by waiting until 6 weeks postoperatively to perform the survey, we felt that waiting until the initial postoperative healing period was over to assess our outcome was important. Finally, our sample only reflected 30% of all patients undergoing urethral meatotomy, and outcomes may have differed between respondents and non-respondents. Nonetheless, our response rate was fairly high for a non-incentivized mail survey. Further, the non-responders had a similar variety in surgeons as the responders, which is a proxy for suture use and perioperative experience.

Conclusion

Urethral meatotomy is common, safe, and effective, with a majority of patients reporting symptomatic improvement after the procedure. Boys undergoing urethral meatotomy for a urinary stream abnormality were more likely to report improved symptoms than those presenting with dysuria or storage symptoms. The use of suture was not associated with patient-reported postoperative outcomes.

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References

1. Bazmamoun H, Ghorbanpour M, Mousavi-Bahar SH. Lubrication of circumcision site for prevention of meatal stenosis in children younger than 2 years old. *Urol J*. 2008; 5:233–6. [PubMed: 19101896]
2. Joudi M, Fathi M, Hiradfar M. Incidence of asymptomatic meatal stenosis in children following neonatal circumcision. *J Pediatr Urol*. 2011; 7(5):526–8. [PubMed: 20851685]
3. Upadhyay V, Hammodat HM, Pease PW. Post circumcision meatal stenosis: 12 years' experience. *N Z Med J*. 1998; 111(1060):57–8. [PubMed: 9539919]

4. Cubillos J, George A, Gitlin J, Palmer LS. Tailored sutureless meatoplasty: A new technique for correcting meatal stenosis. *J Pediatr Urol.* 2012; 8:92–96. [PubMed: 20980203]
5. Godley SP, Sturm RM, Durbin-Johnson B, Kurzrock EA. Meatal stenosis: a retrospective analysis of over 4000 patients. *J Pediatr Urol.* 2015; 11(1):38.e1–6. [PubMed: 25703201]
6. Cartwright PC, Snow BW, McNees DC. Urethral urethral meatotomy in the office using topical EMLA cream for anesthesia. *J Urol.* 1996; 156:857–859. [PubMed: 8683801]
7. Priyadarshi V, Puri A, Singh JP, Mishra S, Pal DK, Kundu AK. Urethral meatotomy using topical anesthesia: A painless option. *Urol Ann.* 2015; 7(1):67–70. [PubMed: 25657548]
8. Fronczak CM, Villanueva CA. Clinic urethral meatotomy under topical anesthesia. *J Pediatr Urol.* 2017 epub ahead of print.
9. Van Howe RS. Incidence of meatal stenosis following neonatal circumcision in a primary care setting. *Clin Pediatr (Phila).* 2006; 45(1):49–54. [PubMed: 16429216]
10. Mahmoudi H. Evaluation of meatal stenosis following neonatal circumcision. *Urol J.* 2005; 2(2): 86–8. [PubMed: 17629876]
11. Ben-Meir D, Livne PM, Feigin E, Djerassi R. Urethral meatotomy using local anesthesia and sedation or general anesthesia with or without penile block in children: a prospective randomized study. *J Urol.* 2011; 185
12. Smith DP, Gjellum M. The efficacy of LMX versus EMLA for pain relief in boys undergoing office urethral meatotomy. *J Urol.* 2004; 172:1760–1761. [PubMed: 15371808]
13. Austin PF, Bauer SB, Bower W, Chase J, Franco I, Hoebeke P, et al. The standardization of terminology of lower urinary tract function in children and adolescents: Update report from the standardization committee of the International Children's Continence Society. *Neurourol Urodyn.* 2016; 35(4):471–481. [PubMed: 25772695]

Table

Patient characteristics and key outcomes stratified by patient-reported improvement

	Not “much improved” (<i>n</i> =38)	“Much improved” (<i>n</i> = 144)	<i>p</i> -value
<i>Patient characteristics</i>			
Indication (<i>n</i> , %)			
Stream abnormality	26/141 (18.4%)	115/141 (81.6%)	0.014*
Pain	11/41 (26.8%)	30/41 (73.2%)	0.40
Storage symptoms	6/30 (20.0%)	24/30 (80.0%)	0.90
Suture used (<i>n</i> , %)	25/131 (19.1%)	106/131 (80.9%)	0.21
<i>Outcomes</i>			
Complications	5/9 (55.6%)	4/9 (44.4%)	0.02*
Reoperation	3/4 (75.0%)	1/4 (25.0%)	0.02*

Table 1

Patient and procedure characteristics stratified by self-reported improvement following urethral meatotomy

	Not “much improved” (<i>n</i> =38)	“Much improved” (<i>n</i> = 144)	<i>p</i> -value
Age category (<i>n</i> , %)			
<1 years old	2/7 (28.6%)	5/7 (71.4%)	0.66
1–4 years old	15/82 (18.3%)	67/82 (81.7%)	0.50
5–12 years old	19/85 (22.4%)	66/85 (77.7%)	Ref.
>13 years old	2/8 (25.0%)	6/8 (75.0%)	0.82
Insurance (<i>n</i> , %) ^a			
Private	29/143 (20.3%)	114/143 (79.7%)	Ref
Public	7/29 (24.1%)	22/29 (75.9%)	0.63
Other	1/5 (20.0%)	4/5 (80.0%)	0.99
Location of procedure (<i>n</i> , %)			
Academic center	9/50 (18.0%)	41/50 (82.0%)	0.38
Satellite hospital	29/132 (22.0%)	103/132 (78.0%)	Ref
Indication (<i>n</i> , %)			
Stream abnormality	26/141 (18.4%)	115/141 (81.6%)	0.014^b
Pain	11/41 (26.8%)	30/41 (73.2%)	0.40
Storage symptoms	6/30 (20.0%)	24/30 (80.0%)	0.90
Suture used (<i>n</i> , %) ^c	25/131 (19.1%)	106/131 (80.9%)	0.21

Not “much improved” = somewhat improved, no change, worse, or much worse; “storage symptoms” = frequency, urgency, nocturia, and/or incontinence.

^aInsurance information was unknown for five patients.

^bSignificance = $p < 0.05$.

^c131 patients had sutures placed at the time of meatotomy.

Table 2

Postoperative outcomes stratified by parent-reported improvement following urethral meatotomy

	Not “much improved” (<i>n</i> =38)	“Much improved” (<i>n</i> = 144)	<i>p</i> -value
Proportion reporting moderate to severe postoperative pain (<i>n</i> ; %)	2/13 (15.4%)	11/13 (84.6%)	0.53
Complications (<i>n</i> ; %)	5/9 (55.6%)	4/9 (44.4%)	0.02*
Required reoperation (<i>n</i> ; %)	3/4 (75.0%)	1/4 (25.0%)	0.02*
Unprompted patient communication (<i>n</i> ; %)	7/25 (28.0%)	18/25 (72%)	0.27
Average number of communications per patient (median, range)	0 (0,3)	0 (0,3)	0.25

Not “much improved” = a collapsed variable including “somewhat improved,” “no change,” “worse,” or “much worse.”

^aSignificance = *p*<0.05.

Table 3

Postoperative outcomes stratified by suture use

	No suture (n = 51)	Suture (n = 131)	p-value
“Much improved” (n; %)	38/144 (26.4%)	106/144 (73.6%)	0.21
Complications (n; %)	2/9 (22.2%)	7/9 (77.8%)	0.49
Required reoperation (n; %)	0/4 (0.0%)	4/4 (100.0%)	0.44 ^a
Unprompted patient communication (n; %)	5/25 (20.0%)	20/25 (80.0%)	0.16
Average number of communications per patient (median, range)	0 (0,3)	0 (0,3)	0.82

Patients without follow-up were considered complication-free; *p*-values for group comparisons were obtained via generalized estimating equations.

^aReoperation rates were compared between two groups using Firth-penalized likelihood (to account for 0-cell).