Pediatric testicular torsion management practices: A survey of Canadian urologists

Wyatt MacNevin[1], Morgan MacDonald[1], Dawn L. MacLellan[1,2], Daniel T. Keefe[1,2]
[1]Department of Urology, Queen Elizabeth II Health Sciences Centre, Halifax, NS, Canada; [2]Division of Pediatric Urology, IWK Health Centre, Halifax, NS, Canada

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Corresponding author: Dr. Daniel T. Keefe, Division of Pediatric Urology, IWK Health Centre, Halifax, NS, Canada; Daniel.keefe@iwk.nshealth.ca

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ABSTRACT

Introduction: Pediatric testicular torsion (TT) is a urologic emergency that may result in testicular loss if left untreated. Testicular salvage is dependent on prompt intervention, and thus delays in diagnosis and management may threaten testicular viability. Knowledge of real-world Canadian practice patterns for pediatric TT will allow optimization of practices based on resource availability and geographic limitations to improve care.
Methods: An electronic survey on pediatric TT management was distributed to Canadian urologists. Descriptive statistics were performed on respondent demographic factors, hospital policies and barriers to care, surgical approaches, and transfer practices. Respondent practice patterns were analyzed based on geographic location and training.
Results: Thirty-four urologists responded, with the majority of respondents operating a community practice. Ultrasonography (US) was frequently used to support TT diagnosis. Despite this, poor US access was often cited as a barrier to care, with particular impact on rural urologists. Neonatal patients and <10 years old were commonly transferred to a pediatric hospital for definitive management due to surgeon discomfort and hospital policies. Reported transport

KEY MESSAGES

- Transfer to pediatric hospital for management of testicular torsion is reported to be common for neonatal patients and those <10 years old.
- Despite ultrasound supporting most pediatric testicular torsion diagnoses, access remains a barrier to care.
- Pediatric urologists reported significantly greater comfort with the surgical management of testicular torsion compared to non-pediatric urologists for neonatal torsion and torsion in patients <10 years old.
- There were no differences in self-reported comfort in managing torsion in children 10–18 years old.

methods commonly included use of the patient's own vehicle or ambulance based on availability and timing.
Conclusions: Neonatal patients and patients under 10 years old are most commonly reported to be transferred to pediatric hospitals for TT management. Patients located in rural locations and at centers with limited US access may be at risk for delayed diagnosis and treatment. Pathways for prompt management of suspected TT may better serve these younger pediatric patients.

INTRODUCTION

Testicular torsion (TT) is a urological emergency associated with sudden and severe testicular pain which may lead to testicular atrophy or loss if left untreated [1]. TT is most common in the pediatric patient population with an incidence of 3.8-5.9 per 100,000 patients less than 17 years of age [1], [2]. Expeditious diagnosis and surgical management of pediatric TT is crucial for maintaining testicular viability, preserving fertility, and reducing pain and distress [3]. Despite the importance of prompt intervention, practice patterns in Canada can vary based on institutional and geographical factors as well as surgeon preference and comfort [4]. These differences in practice patterns directly lead to variability in outcomes and the quality of care that patients receive [4]–[9].

Testicular salvage is directly correlated with time to intervention, thus delays in diagnosis, barriers to appropriate imaging, and transfer to a pediatric hospital when necessary, are all factors which may delay treatment and contribute to increased risk of testicular loss [10], [11]. This risk is accentuated due to the extensive geographical size of Canada in relation to the number of pediatric hospitals, urologists comfortable treating pediatric TT, and limited anesthesia services for pediatric patients in rural settings. Despite this variability in TT management, there is limited data on practice patterns by Canadian urologists. With knowledge of real-world practice patterns for pediatric TT, treatment approaches can be optimized based on resource availability and geographical limitations [7], [12].

The primary objective of this study is to identify the variability in pediatric TT management based on practice type and geographical location of the treating urologist. Secondary objectives include determining the barriers to patient care based on hospital type and resource availability. Furthermore, the surgical approach for management of pediatric TT, and the comfort level of urologists in treating torsion based on patient age group was explored.

METHODS

After research and ethics approval was obtained, an electronic survey was developed and distributed in English to Canadian urologists through UroComm, a monthly correspondence email sent on behalf of the Canadian Urological Association, and through advertising via social media (ie. Twitter/X). Data was collected and stored anonymously using Opinio (Object Plant, Oslo, Norway) with responses being accepted for 8 weeks. No compensation was provided for completing the survey.

Survey structure

A 30 question survey was developed based on review of the current literature on pediatric TT management [7], [12], [13]. The survey consisted of questions on respondent demographic information (eg. Training, years in practice, location and practice type), hospital-based policies and barriers in the management of pediatric TT, assessment and surgical approach to TT management, and current practices related to transferring patients to a pediatric hospital for definitive surgical management.

Statistical methods and data analysis

Survey data was exported into IBM Statistical Package for the Social Sciences (SPSS) software (version 28). Descriptive statistics were performed on respondent demographic factors, hospital policies and barriers to care, surgical approaches, and transfer practices. Chi-square analysis and independent samples T-test was performed analyzing practice patterns based on respondent location and fellowship training. Incomplete responses were excluded from analysis. A 95% confidence interval was used for determining statistical significance. The significance threshold was set at $p = 0.05$.

RESULTS

Demographics

Thirty four urologists responded to the survey with the majority of respondents being located in Ontario (29.4%, n = 10/34) and Nova Scotia (20.6%, n = 7/34). As there are approximately 730 active Canadian urologists, this represents 4.7% of the Canadian urology community [14]. Most respondents held a community practice (70.6%, n = 24/34) and 70.6% of respondents (n = 24/34) reported that pediatric elective cases were performed by the respondent at their hospital of practice. When asked about geographical location, there was an approximately equal representation of respondents in terms of distance of their practice to the nearest pediatric hospital (Table 1).

The majority of respondents underwent fellowship training (67.6%, n = 23/34), with 23.5% (n = 8/34) completing fellowship training in Pediatric Urology. Similarly, 38.2% (n = 13/34) identified General Urology (Non-subspecialty) as their primary specialty of practice, followed by Pediatric Urology (20.6%, n = 7/34) (Table 2).

Hospital policy

When examining hospital policies and cut-offs for surgical management of pediatric TT, 35.0% (n = 9/26) of community urologists reported that there were no age-based cut-offs or policies for pediatric patients requiring an operation at their centre. Similarly, American Society of Anesthesiologists (ASA) score was not utilized by 35.5% (n = 12/34) of respondents for pediatric patients. Only 7.7% (n = 2/26) of community urologists indicated pubertal status was used for operative planning at their hospital. There were no significant differences in hospital policies regarding cut-offs for care when comparing pediatric urologists with non-pediatric urologists ($p > 0.05$).

Barriers to care

Access to appropriate ultrasonography (US) was reported as a barrier by 25.0% (n = 8/32) of respondents (Table 3). Despite 41.2% (n = 14/34) of respondents reporting that scrotal/testicular US is available all of the time at their institution, 58.8% (n = 20/34) reported US access being only available during daytime hours and on special request after normal working hours which posed as a barrier to diagnosis and care. US access being a barrier to care was more common in respondents who were located greater than 100 km from a pediatric hospital, with 75% (n = 12/16) of respondents reporting reduced access compared to 25% (n = 3/12) of those located within 100 km ($p = 0.009$).

Torsion assessment and management

US use in suspected TT was always used by 67.6% (n = 23/34) of respondents with only 26.5% (n = 9/34) using US solely in cases of diagnostic uncertainty. Non-pediatric urologists relied on US for diagnosis (76.9%, n = 20/26) more than pediatric urologists (42.9%, n = 3/4) ($p = 0.05$). There was no difference in reliance on US for TT diagnosis based on respondent distance from a pediatric hospital for non-pediatric urologists ($p = 0.5$). US was primarily performed by radiologists or radiology technicians (97.1%, n = 33/34). Furthermore, the use of the Testicular Workup for Ischemia and Suspected Torsion (TWIST) scoring system for suspected TT was only used routinely by 15.1% (n = 5/33) of respondents, with 45.5% (n = 15/33) reporting that they were not familiar with the TWIST score for TT assessment.

During orchidopexy, 57.6% (n = 19/33) perform 3-point fixation and 36.4% (n = 12/33) use 2-point fixation. There were no significant differences between fixation methods between pediatric urologists and non-pediatric urologists (2-point fixation: 42.9%, n = 3/7 vs 34.6%, n = 9/26, 3-point fixation: 42.9%, n = 3/7 vs 61.5%, n = 16/26, $p = 0.48$). Geographical location had no significant impact on fixation method used by non-pediatric urologists ($p = 0.309$). Fixation of the contralateral testicle was often performed by pediatric urologists with 85.7% (n = 6/7) always performing fixation during time of surgery. Of this group, 14.3% (n = 1/7) perform fixation only if there are proven signs of torsion intraoperatively. Non-pediatric urologists (80.8%, n = 21/26) routinely fixate the contralateral testicle during orchidopexy for TT ($p = 0.865$).

Urologist comfort level

Pediatric urologists self-reported significantly higher comfort levels with managing TT compared to non-pediatric urologists for both neonatal patients (4.86 ± 0.38 vs 1.65 ± 0.85, $p < 0.01$) and patients younger than 10 years of age (5.00 ± 0.0 vs 4.00 ± 1.02, $p = 0.015$) (Table 4). There was no difference in self-reported comfort level in surgical management of TT in patients aged 10 to 18 years old between pediatric urologists and non-pediatric urologists (5.00 ± 0.00 vs 4.81 ± 0.49, p = 0.314).

Transfer practices
Surgeon discomfort was reported as a barrier to treatment by 73.1% (n = 19/26) of non-pediatric urologists compared to 0% of pediatric urologists (p = 0.001). Similarly, 76.9% (n = 20/26) of non-pediatric urologists reported anesthesia discomfort being a barrier to treatment (p = 0.016). For patients less than 10 years of age and non-neonates, local treatment of torsion was most common (80.8%, n = 21/26) with only 19.2% (n = 5/26) transferring patients to pediatric urology. Main reasons for transfer included surgeon discomfort: 15.4% (n = 4/26), anesthesia discomfort: 15.4% (n = 4/26), and hospital policy: 11.5% (n = 3/26) (Table 5).

All respondents, 100% (n = 26/26), would treat TT in patients aged 10-18 years old locally without transfer to pediatric urology. If transfer was required, reasons were attributed to anesthesia discomfort: 11.5% (n = 3/26), and hospital policy: 3.8% (n = 1/26).

Transfer logistics
For all patient age groups, there were no significant differences in reasons to transfer based on rural location with a distance > 100 km from a pediatric hospital. When patients are transferred to pediatric urology, the patient's own vehicle (57.7%, n = 15/26) and ambulance (53.8%, n = 14/26) are commonly utilized options, with air transfer being less common (7.7%, n = 2/26). Reasons provided for utilizing the patient's own transportation included increased wait times if waiting for an ambulance for transport. When estimating transfer times, 32.3% (n = 11/34) of respondents reported that patients arrive at the pediatric hospital in less than 2 hours on average. Approximate transfer time was less than 1 hour (50%, n = 6/12) for patients located less than 100 km from a pediatric hospital. Only 25% (n = 4/16) of respondents located greater than 100 km from a pediatric hospital reported transfer times between 1 – 2 hours, with the majority being greater than 3 hours (31%, n = 5/16).

DISCUSSION
Barriers to care in the management of pediatric TT exist in Canada and vary based on geographical location [4]. US access was the most commonly cited barrier to TT care, with over 50% of respondents indicating that after-hours US access was limited and only available in special cases. Furthermore, US access was more limited in rural centres located further from a pediatric centre. This is particularly important to consider as the majority of respondents indicated that US is required prior to surgical intervention in their practice. With reduced US access and the reliance on US prior to surgical intervention, patients who present with TT after-hours or at centres with reduced US access may face prolonged time to intervention. This may lead to increased rates of orchiectomy as emergency department wait times greater than 1 hour for patients with TT is associated with increased orchiectomy rates [10]. This risk may be further increased if patients require transfer to a pediatric hospital which may subsequently prolong care [8].

Children aged 10 years or younger were most commonly transferred to a pediatric hospital for definitive care with an average transfer time of 2 hours for those located greater than 100 km away. As duration of symptoms less than 6 hours remains a significant factor associated with testicular salvage, these patients are at risk for testicular loss [15]. This is in agreement with a recent study demonstrating that additional transfer time was associated with increased orchiectomy rates in pre-pubertal patients [10], [16]. To further complicate care for this patient group, US access was more limited in rural centres in which patients face increased transfer times which may further increase the risk of testicular loss [8], [11].

Surgeon discomfort, anesthesia discomfort, and hospital policies were all significant factors leading to transfer of patients less than 10 years of age with TT. When examining hospital policies, ASA score and age, and not pubertal status, were more commonly used which aligns with current decision tools used for both the general pediatric and adult operative population [17]. Self-reported confidence in treatment of TT in neonatal patients and patients less than 10 years of age was higher in pediatric urologists in keeping with the reported transfer practices. For patients 11 years of age and older, there were no significant differences in self-reported comfort and preference for transfer to a pediatric centre. Therefore, efforts to expedite diagnosis of TT presentations in patients 10 years of age or younger may be a potential area for improvement as these patients are more likely to be transferred to a pediatric hospital [8], [10]. This is especially true for neonatal torsion which should exclusively be managed by pediatric urologists [18]. Additionally, to improve urologist comfort in treating pediatric TT, more comprehensive exposure and training in residency should be considered to reduce the need for transfer to a pediatric centre.

Treatment of pediatric TT is complicated for a number of reasons including its time-sensitive nature, use of imaging to aid diagnosis, and factors such as surgeon/anesthetist discomfort and hospital policies which may require patient transfer for treatment. Proposed pathways to improve pediatric TT management must be inclusive of all these factors [19]–[21]. Based on the barriers to care identified in this study, emergency department pathways can be better optimized for children such that testicular exams are routinely performed on patients presenting with abdominal or groin pain to not misdiagnose or delay diagnosis of torsion [22]. Additionally, when patients are noted to have groin/testicular pain noted at triage, pathways should be developed to facilitate more urgent assessment by an emergency physician with a streamlined protocol to facilitate concurrent US assessment and urology referral to minimize emergency department wait time, with particular attention on younger patients who are more likely to require transfer [19], [23]. The use of the TWIST score, a risk-based score system using features of clinical history and physical examination, should further be used to streamline emergency department TT care pathways [24]. Further education may be required for emergency physicians to become comfortable and competent in utilizing the TWIST scoring system which may reduce the need for US and expedite care. To address reduced US access, advocacy efforts should be made for acquiring portable US machines in more rural locations with limited US access and radiologist availability [5], [14]. This should be combined with mandatory training for urologists and emergency physicians on scrotal US in instances where radiology is not accessible [10], [23]. Dedicated POCUS training for urologists would expedite care and work to improve patient outcomes [10].To optimize patient transfer for TT treatment, site-specific guidelines must be developed based on available resources (ie. US and radiologist availability, ambulance availability) and geographical distance to the nearest pediatric hospital. A thorough review of each centre's current process for diagnosis and treatment/transfer will allow for identification of areas in TT treatment that contribute to delay which can then be targeted for improvement. As surgeon and anesthetist discomfort were identified as areas leading to patient transfer, continuing medical education initiatives on pediatric testicular torsion management along with more emphasis on pediatric torsion during residency training may reduce the need for transfer and expedite care. Lastly, population-based efforts to increase knowledge of TT is important to support the prompt presentation to the emergency department when patients are experiencing symptoms [25], [26].

This study exists, to our knowledge, as one of the only Canadian studies to investigate real-world pediatric TT practices with consideration of geographical barriers and identifies potential areas of improvement for TT management. Of note, the majority of respondents in our study were community urologists with varied geographical location and practice experience, reflecting the majority of practicing urologists in Canada [14].

This study has some limitations. The limitations of this study includes the low response rate of 4.7% of urologists associated with CUA and the ~~there was a~~ higher percentage of respondents having completed fellowship training in pediatric urology (approximately 20%) than expected, likely due to the subject of this study and its broad distribution to the Canadian urology membership. This may bias the results of this study due to the over-representation of pediatric urologists. Additionally, the low response rate means that the TT practice patterns of the majority of community urologists remain uncaptured. ~~Sub-group analysis examining pediatric urologist respondents and non-pediatric urologists was performed to allow for comparison while controlling for this bias. Furthermore, it is important to note that~~ Furthermore confidence in treatment of TT was self-reported with no objective outcomes measured with respect to complication rate and testicular salvage. Due to the self-reported nature of surgical comfort in the management TT, it is possible scores may not reflect actual competence. Future studies comparing outcomes between pediatric urologists and non-pediatric urologists performing orchidopexy for pediatric TT may provide more strength to this finding. Additionally, this study utilized a survey approach eliciting respondent's perspectives of their practices and did not quantify pediatric TT volume at their centre, number of transfers, and/or transfer time on a case-by-case basis. Furthermore, with respect to TT evaluation, the use of US in the survey did not explicitly include POCUS which may be helpful in qualifying POCUS use as an area of improvement. Future studies are planned to quantify these practices while examining testicular salvage rates based on emergency department triage and transfer times.

CONCLUSIONS

Pediatric TT requires prompt investigation and surgical management. Results from this study have identified that patients under 10 years of age are more commonly transferred to pediatric urology for intervention. Furthermore, patients in rural locations located further away from a pediatric hospital, and those located at centres with reduced access to US imaging may be further at risk for testicular death and require additional efforts to improve US access and prompt transfer when necessary. With improved understanding of the real-world practices for pediatric TT in Canada, guidelines and practices may be improved to better serve these at-risk patients.

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FIGURES AND TABLES

Table 1. Respondent geographic and practice demographics

Practice Location – Province/territory	**Frequency (%)**
Nova Scotia	7 (20.6)
New Brunswick	6 (17.6)
Prince Edward Island	1 (2.9)
Quebec	5 (14.7)
Ontario	10 (29.4)
Manitoba	1 (2.9)
Saskatchewan	1 (2.9)
Alberta	1 (2.9)
British Columbia	1 (2.9)
Newfoundland	1 (2.9)
Northwest Territories	0 (0)
Nunavut	0 (0)
Yukon	0 (0)
Practice type (multiple selections allowed)	
Pediatric hospital	5 (14.7)
Academic – adult hospital	6 (17.6)
Academic – adult and combined pediatric hospital	3 (8.8)
Community practice	24 (70.6)
Community locum practice	1 (2.9)
Pediatric elective cases performed at site	
Yes	24 (70.6)
No	8 (23.5)
Other – low-risk (e.g., circumcision only)	2 (5.9)
Distance to nearest pediatric hospital, km	
N/A	5 (15.2)
<20	4 (10.3)
20–50	4 (10.3)
51–100	4 (10.3)
101–200	7 (21.2)
201–400	3 (9.1)
>400	6 (15.4)

Table 2. Respondent training and experience	
Years in practice	**Frequency (%)**
<5 years	9 (26.5)
5–10 years	7 (20.6)
11–15 years	7 (20.6)
16–20 years	7 (20.6)
21–25 years	2 (5.9)
>25 years	2 (5.9)
Fellowship training	
Pediatric urology	8 (23.5)
Endourology and stone disease	4 (13.8)
Minimally invasive surgery, robotics	5 (17.2)
Transplant urology	2 (6.9)
Oncology	1 (3.4)
Functional and reconstructive urology	3 (10.3)
N/A	11 (37.9)
Primary subspecialty of practice	
Pediatric urology	7 (21.2)
Endourology and stone disease	6 (18.2)
Minimally invasive surgery, robotics	2 (6.1)
Transplant urology	1 (3.0)
Oncology	1 (3.0)
Functional and reconstructive urology	2 (6.1)
Andrology	1 (3.0)
N/A – general urology	13 (39.4)

Table 3. Barriers to care, evaluation, and surgical management of testicular torsion by pediatric and adult urologists			
	Pediatric urologist, frequency (%)	**Adult urologist, frequency (%)**	**p**
Reduced ultrasound access			
Yes	1 (14.3)	7 (28.0)	0.503
No	6 (85.7)	18 (72.0)	
Anesthesia discomfort			
Yes	0 (0.0)	3 (8.00)	0.512
No	6 (100.0)	22 (88.0)	
Hospital policies			
Yes	0 (0.0)	3 (8.00)	0.512
No	6 (100.0)	22 (88.0)	
Surgeon discomfort			
Yes	0 (0.0)	1 (4.00)	0.618
No	6 (100.0)	24 (96.0)	
Evaluation and surgical management			
Use of TWIST score routinely			
Yes	3 (42.9)	2 (8.33)	*0.02*
No	4 (57.1)	24 (91.7)	
Use of TWIST when diagnosis unclear			
Yes	0	0	–
No	7 (100)	26 (100)	
Use of TWIST with low suspicion			
Yes	1 (14.3)	5 (19.2)	0.624
No	6 (85.7)	21 (80.8)	
Fixation method			
1-point	1 (14.2)	1 (3.84)	0.489
2-point	3 (42.9)	9 (34.6)	
3-point	3 (42.9)	16 (61.5)	
Contralateral fixation			

Yes	6 (85.7)	1 (3.84)	0.865
No	0 (0)	21 (80.8)	
Only if proven ipsilateral torsion	1 (14.3)	4 (15.4)	

Table 4. Self-reported comfort in surgical management of testicular torsion by age group			
	Pediatric urologist, mean ± SD	**Adult urologist**	**p**
Neonatal	4.86±0.378	1.65±0.846	<0.0001
<10 years old	5.00±0.00	4.00±1.020	0.015
10–18 years old	5.00±0.00	4.81±0.491	0.315

SD: standard deviation.

Table 5. Reasons for patient transfer by patient age group			
	Pediatric urologist, frequency (%)	**Adult urologist, frequency (%)**	**p**
Patient age <10 years old			
Surgeon discomfort	0/7 (0)	4/26 (15.4)	0.01
Anesthesia discomfort	0/7(0)	4/26 (15.4)	0.01
Hospital policy	0/7(0)	3/26 (11.5)	0.190
Patient age 10–18 years old			
Surgeon discomfort	0/7 (0)	0/26 (0)	–
Anesthesia discomfort	0/7(0)	3/26 (11.5)	0.190
Hospital policy	0/7 (0)	1/26 (3.8)	0.532