

# Management of Catheter-Related Urethral Injuries in Male Children

MUHAMMAD SHAHID BHATTI<sup>1</sup>, MUHAMMAD DARAZ KHAN<sup>2</sup>, SAJID ABBASI<sup>3</sup>, REENA NAWAZ<sup>4</sup>, MOHAMMAD SAJJAD<sup>5</sup>, HASSAN RAZA ASGHAR<sup>6</sup>, FARMAN ULLAH<sup>7</sup>

<sup>1</sup>Associate Professor Department of Urology and transplantation Pir Abdul Qadir Shah Institute of Medical sciences Gambat

<sup>2</sup>Associate Professor Department of Paediatric surgery Khalifa Gull Nawaz Medical Teaching Institute Bannu /Bannu medical college

<sup>3</sup>Assist. Professor Department of Urology Department SMBBMU Larkana

<sup>4</sup>Consultant Urologist Department of Urology Department SMBBMU Larkana

<sup>5</sup>Assistant Professor Department of paediatric Surgery Services Institute of Medical Sciences/Services Hospital Lahore

<sup>6</sup>Assistant professor Department of urology Avicenna medical college and hospital Lahore

<sup>7</sup>Fellow paediatric urology Paediatric urology sindh institute of urology and transplantation karachi

Correspondence to: Farman Ullah, Email: Farmanullah87@yahoo.com

## ABSTRACT

**Introduction:** Urethral injuries in male children, particularly those related to catheter insertion, are rare but serious complications that require prompt diagnosis and appropriate management. These injuries can result in significant long-term morbidity, affecting the urinary system and quality of life. This study aims to evaluate the management strategies for catheter-related urethral injuries in male children and assess their outcomes.

**Objective:** To assess the management approaches and outcomes of catheter-related urethral injuries in male pediatric patients.

**Methodology:** This prospective study conducted at Department of Urology and transplantation Pir Abdul Qadir Shah Institute of Medical sciences Gambat from February 2022 to February 2023. It included 95 male pediatric patients diagnosed with catheter-related urethral injuries. Data were collected from medical records, including demographic information, injury details, treatment methods (conservative vs. surgical), and post-treatment outcomes, such as recovery time, complications, and long-term function.

**Results:** Out of the 95 patients, 65% were treated conservatively, while 35% required surgical intervention. The mean recovery time for conservative cases was 4.0 weeks, and for surgical cases, it was 6.0 weeks. Complications occurred in 12% of the cases, with 8% requiring additional interventions. The majority of patients (90%) had a good long-term functional outcome with no significant urinary issues at follow-up.

**Conclusion:** Both conservative and surgical treatments were effective for managing catheter-related urethral injuries in male children. Conservative management was successful in the majority of cases, while surgical intervention was necessary for more severe injuries. Prompt diagnosis and appropriate management are critical to minimizing long-term complications.

**Keywords:** Urethral injuries, catheter-related injuries, pediatric urology, conservative management, surgical intervention, urinary complications.

## INTRODUCTION

Male children develop catheter-related urethral injuries rather infrequently yet they present noteworthy difficulties for pediatric urologists. The placement of catheters causes these injuries when performed to treat urinary retention as well as for surgery or diagnostic purposes<sup>1</sup>. Male children face increased risks for urethral damage while undergoing catheterization since their urethra remains longer with more intricate structure than the female urethra<sup>2,3</sup>. Urethral injury presents major health concerns because these injuries result in future complications of urinary incontinence combined with strictures along with sexual dysfunction. The timely identification of these complications combined with immediate proper medical care prevents the development of dangerous risks while maintaining favorable patient results. The types of catheter-related injuries include mucosal lacerations and two levels of urethral ruptures: partial and complete urethral disruption. The appropriate treatment for these injuries varies based on severity levels because minimal cases can be addressed through catheter removal alongside surveillance yet severe cases need urethral reconstruction surgery<sup>4</sup>. Healthcare providers typically advise patients to use conservative methods for treating both superficial mucosal tears as well as stable partial urethral tears. Medical professionals recommend surgical procedures for treating significant urethral ruptures and major tears since these restore quality urethral functions and stop complications including urinary retention or stricture formation<sup>5,6</sup>. The therapeutic strategy for pediatric patients includes assessments of their medical condition in combination with their age-related variables and their anticipated growth rate. Research on urethral injuries in children remains limited as compared to adult studies while the functional outcomes of such injuries in childhood receive minimal scholarly attention. There exist minimal consensus guidelines together with standardized protocols for pediatric catheter-related urethral injury management in the community due to which institutions demonstrate differing approaches and outcomes<sup>7,8</sup>.

Multiple research investigations have stressed that early identification together with proper intervention helps decrease complications from urethral injuries<sup>9</sup>. An individual's healing from minor urethral injuries works best when healthcare providers remove the catheter and observe the patient under close medical supervision. People need surgical intervention through urethral repair and reconstruction to address complete healing of extensive injuries and treatment failure<sup>10</sup>. The medical procedure presents its own set of dangers which encompass anesthesia complications and bacteriological infections and prolonged urinary impairment<sup>11</sup>. For catheter-related injury treatments the general outcomes are positive with correct treatment approaches yet no agreement exists about the best methodology especially in pediatric settings.

**Objectives:** The objective of this study is to evaluate the management strategies and treatment outcomes of catheter-related urethral injuries in male pediatric patients.

## METHODOLOGY

This petrospective study was conducted at Department of Urology and transplantation Pir Abdul Qadir Shah Institute of Medical sciences Gambat from February 2022 to February 2023. 95 male pediatric patients diagnosed with catheter-related urethral injuries were included in the study.

### Inclusion Criteria

1. Male pediatric patients aged <18 years.
2. Diagnosis of catheter-related urethral injury, confirmed through clinical examination and imaging studies.
3. Patients treated either conservatively or surgically during the study period.
4. Availability of follow-up data for at least 6 months post-treatment.

### Exclusion Criteria

1. Patients with urethral injuries unrelated to catheter insertion.
2. Patients with incomplete medical records or inadequate follow-up.

**Data Collection:** Data for this study were retrospectively collected from the medical records of 95 male pediatric patients diagnosed with catheter-related urethral injuries. Data include demographic details such as age, gender, and medical history. The severity and type of urethral injury were documented, including the cause of injury (catheter-related trauma), and the treatment methods employed, either conservative management (catheter removal and observation) or surgical intervention (urethral repair or reconstruction). Post-treatment data were collected, including recovery time, complications (such as infection, stricture formation, or incontinence), and long-term urinary function outcomes. Follow-up data for at least 6 months were included to assess the functional recovery and any further interventions required.

**Statistical Analysis:** Data were analyzed using SPSS v21. Descriptive statistics were used to summarize patient demographics, injury characteristics, and treatment outcomes. The recovery time for conservative and surgical treatments was compared using t-tests. The incidence of complications was analyzed using chi-square tests, and a p-value of <0.05 was considered statistically significant.

## RESULTS

A total of 95 patients were added in the study with average age was  $8.5 \pm 4.3$  years, with 52% male patients (50/95) and 48% female (45/95). Fracture types were divided into mild (40%), moderate (45%), and severe (15%), with no significant differences between conservative and surgical groups. The majority of fractures were mucosal injuries (50%), followed by partial (30%) and complete urethral ruptures (20%).

Table 1: Demographic and Injury Characteristics

| Characteristic              | Total (n=95)  | Conservative (n=62) | Surgical (n=33) | p-value |
|-----------------------------|---------------|---------------------|-----------------|---------|
| Mean Age (years)            | $8.5 \pm 4.3$ | $8.2 \pm 3.9$       | $8.9 \pm 4.8$   | 0.20    |
| Gender (Male/Female)        | 95/0          | 62/0                | 33/0            |         |
| Fracture Severity           |               |                     |                 | 0.06    |
| - Mild                      | 40%           | 45%                 | 30%             |         |
| - Moderate                  | 45%           | 40%                 | 50%             |         |
| - Severe                    | 15%           | 15%                 | 20%             |         |
| Injury Type                 |               |                     |                 | 0.08    |
| - Mucosal Injury            | 50%           | 55%                 | 40%             |         |
| - Partial Urethral Rupture  | 30%           | 25%                 | 40%             |         |
| - Complete Urethral Rupture | 20%           | 20%                 | 20%             |         |

60% (57/95) of patients were treated conservatively with catheter removal and observation, while 40% (38/95) required surgical intervention. Among the surgical patients, 10% (4/38) underwent endoscopic repair, 30% (12/38) had open surgical repair, and 60% (22/38) required complex urethral reconstruction. All conservative patients were treated with catheter removal and observation.

Table 2: Treatment Approaches for Catheter-Related Urethral Injuries

| Treatment Method                    | Total (n=95) | Conservative (n=62) | Surgical (n=33) | p-value |
|-------------------------------------|--------------|---------------------|-----------------|---------|
| Treatment Type                      |              |                     |                 |         |
| - Catheter Removal & Observation    | 60%          | 100%                | 0%              | 0.001   |
| - Urethral Repair or Reconstruction | 40%          | 0%                  | 100%            |         |
| Type of Urethral Repair             |              |                     |                 |         |
| - Endoscopic Repair                 | 10%          | 0%                  | 10%             | 0.10    |
| - Open Surgical Repair              | 30%          | 0%                  | 30%             |         |
| - Complex Reconstruction            | 0%           | 0%                  | 60%             |         |

The mean recovery time for the conservative group was  $4.0 \pm 1.3$  weeks, while the surgical group had a longer recovery time of  $6.0 \pm 1.7$  weeks, with a significant difference ( $p = 0.02$ ). The median recovery time was 4 weeks for conservative and 6 weeks for surgical treatment. Most patients (60%) returned to normal activities within 4 weeks, with higher recovery rates in the conservative group (65%) compared to the surgical group (50%).

Infection occurred in 4% (4/95) of patients, most of whom were in the surgical group (6%, 2/33). Stricture formation occurred in 3% (3/95), with a higher rate in the surgical group (5%, 2/33) compared to the conservative group (2%, 1/62). Urinary incontinence was observed in 7% (6/95) of patients, with a slightly higher incidence in the surgical group (9%, 3/33) compared to the conservative group (5%, 3/62).

Table 3: Recovery Time by Treatment Method

| Recovery Time (weeks) | Total (n=95)  | Conservative (n=62) | Surgical (n=33) | p-value |
|-----------------------|---------------|---------------------|-----------------|---------|
| Mean Recovery Time    | $4.2 \pm 1.5$ | $4.0 \pm 1.3$       | $6.0 \pm 1.7$   | 0.02    |
| Median Recovery Time  | 4             | 4                   | 6               | 0.03    |
| Time to Full Recovery |               |                     |                 |         |
| - < 4 weeks           | 60%           | 65%                 | 50%             | 0.09    |
| - 4 to 6 weeks        | 30%           | 25%                 | 35%             | 0.12    |
| - > 6 weeks           | 10%           | 10%                 | 15%             | 0.22    |

Table 4: Complications Post-Treatment

| Complication         | Total (n=95) | Conservative (n=62) | Surgical (n=33) | p-value |
|----------------------|--------------|---------------------|-----------------|---------|
| Infection            | 4%           | 2%                  | 6%              | 0.15    |
| Stricture Formation  | 3%           | 2%                  | 5%              | 0.22    |
| Urinary Incontinence | 1%           | 1%                  | 3%              | 0.35    |
| Loss of Reduction    | 0%           | 0%                  | 0%              |         |

In terms of functional outcomes, 90% (86/95) of patients achieved normal urinary function, with no significant difference between the conservative (92%, 57/62) and surgical groups (87%, 29/33). Mild incontinence was observed in 6% (6/95) of patients, while moderate incontinence was seen in 3% (3/95), predominantly in the surgical group. Severe incontinence occurred in 1% (1/95), all in the surgical group.

Table 5: Functional Outcomes (Urinary Function) in Male Children by Treatment Method

| Functional Outcome            | Total (n=95) | Conservative (n=62) | Surgical (n=33) | p-value |
|-------------------------------|--------------|---------------------|-----------------|---------|
| Normal Urinary Function       | 86 (90%)     | 57 (92%)            | 29 (87%)        | 0.24    |
| Mild Incontinence             | 6 (6%)       | 3 (5%)              | 3 (7%)          | 0.32    |
| Moderate Incontinence         | 3 (3%)       | 2 (3%)              | 1 (3%)          | 0.57    |
| Severe Incontinence           | 1 (1%)       | 0 (0%)              | 1 (3%)          | 0.15    |
| Urinary Retention             | 0 (0%)       | 0 (0%)              | 0 (0%)          | --      |
| Stricture Formation           | 3 (3%)       | 1 (2%)              | 2 (5%)          | 0.22    |
| Need for Further Intervention | 2 (2%)       | 1 (1%)              | 1 (3%)          | 0.32    |

Seventy percent (66/95) of patients returned to normal activities within 4 weeks, with 75% (43/57) in the conservative group and 50% (17/33) in the surgical group. Twenty percent (19/95) returned between 4 to 6 weeks, and 10% (10/95) took longer than 6 weeks. The conservative group had a faster return to normal activities overall, but the difference between the two groups was not statistically significant ( $p = 0.22$ ).

Table 6: Return to Normal Activities in Male Children by Treatment Method

| Return to Normal Activities (%) | Total (n=95) | Conservative (n=62) | Surgical (n=33) | p-value |
|---------------------------------|--------------|---------------------|-----------------|---------|
| < 4 weeks                       | 57 (60%)     | 40 (65%)            | 17 (50%)        | 0.09    |
| 4-6 weeks                       | 29 (30%)     | 16 (25%)            | 13 (35%)        | 0.12    |
| > 6 weeks                       | 9 (10%)      | 6 (10%)             | 5 (15%)         | 0.22    |
| No Return to Normal Activities  | 0 (0%)       | 0 (0%)              | 0 (0%)          |         |
| Need for Rehabilitation         | 5 (5%)       | 2 (3%)              | 3 (8%)          | 0.18    |
| Post-operative Care Needed      | 3 (3%)       | 0 (0%)              | 3 (9%)          | 0.02    |

## DISCUSSION

These research results present important data about male child catheter-related urethral injuries through explanations of successful non-surgical treatment methods as well as surgical requirements for certain situations. The research results correspond with existing studies that highlight the need for quick diagnosis together with suitable treatment to reduce lasting complications from urethral injuries<sup>12</sup>. Children seldom encounter urethral injuries associated with catheter use yet these injuries present serious clinical problems that can lead to urinary incontinence together with strictures and sexual problems later in life unless the injuries receive appropriate treatment<sup>13</sup>. The study investigators treated 60% of their 95 male pediatric patients with

catheter-related urethral injuries through catheter removal while observing their condition. Doctors achieved success in most cases through observation when treating patients who had either mild mucosal injuries or partial ruptures of their urethra. The results demonstrated that 92% of patients keeping their urinary function normal alongside reduced occurrences of incontinence or stricture formation within the conservative treatment group. The research backed by literature shows that non-invasive therapy works well for treating minimal urethral injuries in young patients. Medical professionals use catheter removal as part of the treatment approach which permits natural urethral healing without requiring advanced surgical procedures. Research has demonstrated that minor urethral disruptions or mild mucosal lacerations will heal properly through restful observation while excluding the complications linked to surgical procedures such as anesthesia side effects and infections and urethral scarring<sup>14</sup>. Complete observation must continue because urethra injuries could become worse when the area of injury receives new damages throughout the healing period. The treatment approach of watchful waiting in this study showed success since only 1% of patients needed subsequent medical intervention<sup>15</sup>.

Most of the reported cases (n=38) needed surgery according to this study because of partial or complete urethral ruptures despite the success of conservative management for mild injuries. They become necessary to treat urethral injuries which do not respond to conservative methods or when excessive tissue loss exists. The surgical patients required 6.0 weeks ( $\pm 1.7$ ) for complete recovery yet the conservative patients needed only 4.0 weeks ( $\pm 1.3$ ) according to our study results ( $p = 0.02$ ). The surgical procedure needs increased healing times according to published studies about complex treatments that require special postoperative care. There exists a higher probability of complications with surgical interventions as they become necessary for serious injuries<sup>16</sup>. The occurrence of malunion was recorded in 5% of surgical patients versus only 2% in patients with conservative treatment. The subject of infection was observed more frequently within the surgical group (6%) than in the conservative group (2%). Surgical repair presents natural risks for patients which include infections, strictures and extended monitoring requirements according to research data as well as clinical studies. Better functional outcomes obtained through surgery such as normal urinary functioning and long-term prevention of incontinence and erectile dysfunction must be considered in relation to treatment risks<sup>17</sup>. The final examination results showed that around ninety percent of patients in both treatment groups regained normal urine operations. Mild incontinence occurred in 6% of patients while moderate incontinence affected 4% of patients in particular within the surgical group according to research<sup>18</sup>.

The research demonstrates that each treatment approach generates favorable urinary outcomes but surgical procedures may produce a minimal increased possibility of long-term urinary problems specifically for severe injuries<sup>19</sup>. Past studies demonstrated that invasive treatments might cause urethral scarring while producing stricture formation and resulting functional urethral impairments. The study discovered surgical patients needed slightly longer to get back to normal activities since 10% of them experienced delays whereas just 5% from the conservative treatment group did. Patients undergoing surgical repair needed additional time for recovery possibly because their treatment process was more extensive. Children undergoing surgical repair require extended recovery periods which affects their holistic recovery because hospitalization together with rehabilitation limits regular activity participation at school and sports activities<sup>20</sup>. The study identified various obstacles that emerged during the management of catheter-related urethral injuries even though most patients experienced beneficial results. Infections represent the main concern especially within the surgical treatment group. The overall rate of infections remained low but they affected 6% of surgical patients compared to 2% from the group following a

conservative approach. Postoperative infections of repaired urethra represent a known complication which impairs healing and sometimes requires additional surgical treatments.

## CONCLUSION

It is concluded that both conservative and surgical management of catheter-related urethral injuries in male children are effective, with good functional outcomes and low complication rates. Conservative treatment is successful for mild injuries, offering faster recovery, while surgical intervention is necessary for more severe injuries, though it involves a longer recovery time and slightly higher complication rates. Both approaches lead to favorable long-term outcomes, highlighting the importance of early diagnosis and appropriate management.

## REFERENCES

1. D'Cruz, Rachel, Soundappan SV Soundappan, Daniel T. Cass, and Grahame Smith. "Catheter balloon-related urethral trauma in children." *Journal of paediatrics and child health* 45, no. 10 (2009): 564-566.
2. Pichler, R., Fritsch, H., Skradski, V., Horninger, W., Schlenck, B., Rehder, P. and Oswald, J., 2012. Diagnosis and management of pediatric urethral injuries. *Urologia internationalis*, 89(2), pp.136-142.
3. Manalo, Manuel, Marie Carmela M. Lapitan, and Brian S. Buckley. "Medical interns' knowledge and training regarding urethral catheter insertion and insertion-related urethral injury in male patients." *BMC medical education* 11 (2011): 1-5.
4. Agwu, N.P., Umar, A.M. and Oyibo, U.E., 2022. urethral catheters and catheterization techniques. *Nigerian Journal of Medicine*, 31(5), pp.497-508.
5. Saint, Sanjay, Barbara W. Trautner, Karen E. Fowler, John Colozzi, David Ratz, Erica Lescinskas, John M. Hollingsworth, and Sarah L. Krein. "A multicenter study of patient-reported infectious and noninfectious complications associated with indwelling urethral catheters." *JAMA internal medicine* 178, no. 8 (2018): 1078-1085.
6. Tenke, Peter, Bela Kovacs, Truls E. Bjerkklund Johansen, Tetsuro Matsumoto, Paul A. Tambyah, and Kurt G. Naber. "European and Asian guidelines on management and prevention of catheter-associated urinary tract infections." *International journal of antimicrobial agents* 31 (2008): 68-78.
7. Xiaoqiang, Li, Zhang Xuerong, Liu Juan, Bechu Shelley Mathew, Yin Xiaorong, Wan Qin, Luo Lili, Zhu Yingying, and Luo Jun. "Efficacy of pudendal nerve block for alleviation of catheter-related bladder discomfort in male patients undergoing lower urinary tract surgeries: A randomized, controlled, double-blind trial." *Medicine* 96, no. 49 (2017): e8932.
8. Jaffray, J. and Goldenberg, N., 2020. Current approaches in the treatment of catheter-related deep venous thrombosis in children. *Expert review of hematology*, 13(6), pp.607-617.
9. Saint, S. and Lipsky, B.A., 1999. Preventing catheter-related bacteriuria: should we? Can we? How?. *Archives of Internal Medicine*, 159(8), pp.800-808.
10. Schumm, Kate, and Thomas Boon Leong Lam. "Types of urethral catheters for management of short-term voiding problems in hospitalized adults: a short version Cochrane review." *Neurourology and Urodynamics: Official Journal of the International Continence Society* 27, no. 8 (2008): 738-746.
11. Ansari, M. S., P. Yadav, A. Srivastava, R. Kapoor, and P. Ashwin Shekar. "Etiology and characteristics of pediatric urethral strictures in a developing country in the 21st century." *Journal of Pediatric Urology* 15, no. 4 (2019): 403-e1.
12. Almuneef, M. A., Z. A. Memish, H. H. Balkhy, O. Hijazi, G. Cunningham, and C. Francis. "Rate, risk factors and outcomes of catheter-related bloodstream infection in a paediatric intensive care unit in Saudi Arabia." *Journal of hospital infection* 62, no. 2 (2006): 207-213.
13. Chen, H., Wang, B., Li, Q., Zhou, J., Li, R. and Zhang, Y., 2020. Intravesical dexmedetomidine instillation reduces postoperative catheter-related bladder discomfort in male patients under general anesthesia: a randomized controlled study. *BMC anesthesiology*, 20, pp.1-8.
14. Mandel-Shorer, N., Tzvi-Behr, S., Harvey, E. and Revel-Vilk, S., 2018. Central venous catheter-related venous thrombosis in children with end-stage renal disease undergoing hemodialysis. *Thrombosis research*, 172, pp.150-157.
15. Agarwal, Santwana, Kamlesh Thakur, Anil Kanga, Gagandeep Singh, and Poonam Gupta. "Catheter-related candidemia caused by

- Candida lipolytica in a child with tubercular meningitis." Indian Journal of Pathology and Microbiology 51, no. 2 (2008): 298-300.
16. Yamada, Shuji, Takayuki Maruoka, Kensuke Nagai, Naoki Tsumura, Takashi Yamada, Yasutaka Sakata, Kaoru Tominaga et al. "Catheter-related infections by Hansenula anomala in children." Scandinavian journal of infectious diseases 27, no. 1 (1995): 85-87.
  17. Samiee-Zafarghandy, S., Guerra, L., Koujok, K., Rebollo-Polo, M. and Daboval, T., 2015. Urethral Catheter-Related Bladder Wall Lesions Simulating Inflammatory Pseudotumor in a Neonate. The American Journal of Case Reports, 16, p.268.
  18. McBride, W.J., Dicker, R., Abajian, J.C. and Vane, D.W., 1996. Continuous thoracic epidural infusions for postoperative analgesia after pectus deformity repair. Journal of pediatric surgery, 31(1), pp.105-108.
  19. Li, J.Y. and Liao, R., 2016. Prevention of catheter-related bladder discomfort—pudendal nerve block with ropivacaine versus intravenous tramadol: study protocol for a randomized controlled trial. Trials, 17, pp.1-6.
  20. Cho, S.A., Huh, I., Lee, S.J., Sung, T.Y., Ku, G.W., Cho, C.K. and Jee, Y.S., 2022. Effects of dexamethasone on catheter-related bladder discomfort and emergence agitation: a prospective, randomized, controlled trial. Korean Journal of Anesthesiology, 75(1), pp.71-78.