MEDICAL UNIVERSITY OF SOUTH CAROLINA
VALUE INSTITUTE
Evidence-Based Practice Brief
Risk of Urethral Trauma from Urinary Catheterization

Author(s): Amanda Davis, MPH, RD, CHES; Emily Brennan, MLIS

ASK THE QUESTION

Question: Are patients that have urinary catheters (i.e., indwelling or intermittent) placed and/or replaced during hospitalization at increased risk for urethral trauma?

SEARCH FOR EVIDENCE

Databases: PubMed, Scopus, CINAHL


Filters: Humans, English, Published last 10 years

CRITICALLY ANALYZE THE EVIDENCE

There were nine studies found addressing the risk of urethral trauma in hospitalized patients with urinary catheters. One study (Hollingsworth et al., 2013) was a systematic review with meta-analysis regarding the frequency of non-infectious complications after urinary catheterization. They evaluated 37 clinical trials and observational studies for patients with short term (< 3 weeks) and long term (> 3 weeks) urinary catheterization with and without spinal cord injury. Meta-analysis showed that for short-term catheterizations without spinal cord injury, gross hematuria occurred in 4.7% of patients and urethral stricture or erosion occurred in 3.4% of patients. For long-term catheterizations without spinal cord injury, gross hematuria occurred in 43.6% of outpatients. In patients with spinal cord injury, gross hematuria occurs in 13.5% of patients, false passage or trauma occurred 3.1% of patients and urethral stricture or erosion occurs in 8.7% of males and 37.2% of females.

The remaining studies were retrospective observational studies. Three of these studies (D’Cruz et al., 2009; Subramanian et al., 2016; Thomas et al., 2009) reported on urethral trauma in specific patient populations. D’Cruz et al. (2009) reported on six male pediatric patients with urethral injuries due to incorrect balloon inflation in Australia. They found that the catheters were placed by multiple different health care professionals (i.e.,
surgeons, nurses) and that urethral trauma was avoidable in five of the cases. Subramanian et al. (2016) reported on urethral injuries in five patients with spinal cord injuries in the UK. They found that spinal cord injury patients are at increased risk of urethral trauma from intra-urethral Foley catheter balloon inflation due to: 1) lack of sensation in the urethra; 2) urethral false passage due to previous trauma; 3) urethral sphincter spasms; and 4) altered anatomy due to past surgeries. As a result of their findings, Subramanian and colleagues called for an end to the clinical “habit” of using patients with spinal cord injuries for practicing clinical skills by student nurses and interns. Thomas et al. (2009) reported on 51 adult male patients with complications from urinary catheterization by non-urological teams at hospital in Ireland. They found that 74% of urinary traumas resulted from interns performing catheterization, with a significant decrease in urinary traumas as interns completed their training (p < 0.001). Additionally, a survey of interns concluded that 88% felt their practical training was none or inadequate, 80% felt their theoretical training was inadequate, and 52% received no supervision during their first time catheterizing a patient.

One study (Leuck et al., 2012) directly evaluated the risk of urethral trauma versus UTI in predominantly male patients with urinary catheters. They assessed 116 possible UTI episodes (21 symptomatic, 95 asymptomatic) in patients with a Foley catheter at the Minneapolis VA Medical Center, and found that 100 instances of catheter associated genitourinary trauma (i.e., pain, gross hematuria, incidentally noted Foley catheter migration and overt mechanical trauma) occurred in these patients. Trauma episodes with documented pain or prompting an intervention (0.9% of Foley catheter days) were significantly more common than symptomatic possible UTI (0.3% of Foley catheter days, p <0.001).

A study by Manalo et al. (2011) evaluated the knowledge and practices of first year medical interns placing urinary catheters at a hospital in the Philippines. When given a scenario where an elderly male patient is catheterized but there is no urine after 2 hours, only 76.4% correctly identified that the catheter was probably not inserted into the bladder and only 52.9% correctly identified that urethral injury is likely to have been caused by inflation of the catheter balloon while still in the urethra (due to bleeding upon removal).

There were also three quality improvement studies focused on efforts to minimize urethral trauma (Dave et al., 2017; Kashefi et al., 2008; Sullivan et al., 2015) in the hospital setting. Dave et al. (2017) evaluated the implementation of a multidisciplinary Foley Project protocol to reduce urethral trauma in males requiring urinary catheters that included a system-wide catheter education program, difficult urinary catheterization algorithm, and a skilled catheter nursing team. Incidence rates for catheter-associated trauma during placement were significantly decreased (pre: 41.1% vs post: 5.9%, p=0.005) as a result of the protocol. Kashefi et al. (2008) evaluated the implementation of nurse education program regarding proper placement of urethral catheters and urethral catheter safety. The education program resulted in a significant decrease in the risk of iatrogenic urethral catheter injury in hospitalized males by a factor of 4.9 (p=0.006). Sullivan et al. (2015) was a follow-up to the Thomas et al. (2009) study described above after the implementation of a structured urinary catheterization program for interns. There was a significant decrease in urinary catheter-related complications following implementation of the structured program (pre: 6% vs post: 4%, p<0.05), as well as significant increases in practical knowledge (pre: 40% vs post: 70%, p<0.01), theoretical knowledge (pre: 16% vs post: 53%, p<0.01) and confidence in placing urinary catheters (pre: 35% vs post: 63%, p=0.02) by interns.

<table>
<thead>
<tr>
<th>PICO Question: Are patients that have urinary catheters (i.e., indwelling or intermittent) placed and/or replaced during hospitalization at increased risk for urethral trauma?</th>
<th>GRADE CRITERIA (See Appendix A)</th>
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<tr>
<td>Author/Date/Journal</td>
<td>Purpose of Study</td>
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<tr>
<td>Hollingsworth et</td>
<td>To determine the</td>
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Hollingsworth et
<table>
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<tr>
<th>Authors, Year, Journal</th>
<th>Frequency of Non-Infectious Complications After Urinary Catheterization</th>
<th>Methodology</th>
<th>Patients</th>
<th>Results</th>
<th>Study Limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>D'Cruz et al., 2009, Journal of Paediatrics and Health</td>
<td>To review urethral injuries arising from incorrect balloon inflation in children undergoing</td>
<td>Retrospective case series</td>
<td>Six male patients (median 5.5yr) identified over the 11-year period at a single hospital in Australia (1995-2006)</td>
<td>5/6 patients were in the hospital for non-urogenital procedures -2 catheters placed by ICU nurse -2 catheters placed by surgeon -1 catheter inserted by</td>
<td>Study Limitations = None</td>
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</tbody>
</table>

### Non-Experimental/Observational Studies (Case-Control, Cohort, Cross Sectional, Longitudinal, Descriptive, Epidemiologic, Case Study)

- **Systematic Review**
  - Review did not address focused clinical question
  - Search was not detailed or exhaustive
  - Quality of the studies was not appraised or studies were of low quality
  - Methods and/or results were inconsistent across studies

- **Studies inconsistent**
  - (When there are differences in the direction of the effect, populations, interventions or outcomes between studies)

- **Studies are indirect**
  - (Your PICO question is quite different from the available evidence in regard to population, intervention, comparison, or outcome)

- **Studies are imprecise**
  - (When studies include few patients and few events and thus have wide confidence intervals and the results are uncertain)

- **Publication Bias**
  - (e.g. pharmaceutical company sponsors study on effectiveness of drug)

**Increase Quality Rating if:**
- **Large effect**
  - (When the relative risk of association between two factors is large or very large)
- **Dose response**
  - (When the dose-response relationship increases the confidence than an effect is real and for one or more criteria impact the quality of studies sufficiently enough to lower confidence in the estimate of effect)
| Dave et al., 2017, Journal of Healthcare Quality | To evaluate the implementation of a multidisciplinary Foley Project protocol which consisted of a system-wide catheter education program, difficult urinary catheterization algorithm, and skilled catheter nursing team to improve patient outcomes | Retrospective observational (pre-post) | 92 adult male patients with difficult urinary catheterization at a single hospital in Michigan - Pre: (n=74; consults to urology residents – 59.5% for difficult catheterization) - Post: (n=18; consults to skilled catheter nursing team – 88.9% for difficult catheterization) - trauma was either assessed by physical examination (e.g., bleeding at the meatus) and/or by cystoscopy (e.g., false passage) | Incidence rates for catheter-associated trauma during placement were significantly decreased after implementation of the Foley Project (pre: 41.1% vs post: 5.9%, p=0.005) - pre-protocol traumas included false passage 13 (43.3%), gross hematuria 11 (36.7%), and false passage + gross hematuria 6 (20.0%) - the one post-protocol trauma was gross hematuria Incidence rates of false passage were also significantly decreased after implementation of the Foley project (pre: 26.0% vs post: 0%; p=0.02) | Study Limitations = None Non-Experimental/Observational Studies (case-control, cohort, cross sectional, longitudinal, descriptive, epidemiologic, case study/series, survey) ☒ Insufficient sample size ☐ Sample not representative of patients in the population as a whole ☒ Variables (confounders, exposures, predictors) were not described and accounted for ☒ Outcome criteria not objective or were not applied in blind fashion ☐ Insufficient follow-up, if applicable ☐ For prognostic study, sample not defined at common point in course of disease/condition ☐ For diagnostic study, gold standard not applied to all patients ☐ For diagnostic study, no independent, blind comparison between index test and gold standard Quality Improvement (pre-post, controlled pre-post, historical comparison, time series) |

**Urethral trauma was avoidable in five of the cases reported in this series**

-1 catheter insertion unknown
<table>
<thead>
<tr>
<th>Study</th>
<th>Objective</th>
<th>Methods</th>
<th>Results</th>
</tr>
</thead>
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<tr>
<td>Kashefi et al., 2008, <em>The Journal of Urology</em></td>
<td>To study the incidence and prevention of iatrogenic urethral injuries in adult male inpatients</td>
<td>Prospective cohort (pre-post)</td>
<td>8833 adult male patients at 2 academic medical centers in California for a 6-month period before and after nurse education program (properly place urethral catheters and promote urethral catheter safety) -Pre: 4,310 consecutive admissions -Post: 4,523 consecutive admissions Urethral catheter insertion injury = report by the physician requesting a consultation of 1) difficult catheter placement with subsequent poor catheter drainage or 2) inability to place a catheter + at least 1 of the following conditions: urethral and/or perineal pain, blood at the urethral meatus, a non-draining catheter that could not be irrigated, cystoscopic evidence of Injuries: Pre: 14 iatrogenic urethral catheter injuries occurred, representing an incidence of 3.2 injuries per 1,000 adult male admissions - all injuries presented as severe penile and/or perineal pain, and 12 (86%) presented as hematuria Post: 3 iatrogenic urethral catheter injuries occurred for an incidence of 0.7 injuries per 1,000 adult male admissions - all injuries presented as severe penile and/or perineal pain and hematuria - resulted in a significant decrease in the risk of iatrogenic urethral catheter injury by a factor of 4.9 (p=0.006) All injuries in both time periods occurred during attempted placement of urethral catheters by nursing staff</td>
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<td>Leuck et al., 2012, The Journal of Urology</td>
<td>To document and compare the frequency of catheter associated UTI vs Foley catheter (FC) associated genitourinary trauma</td>
<td>Prospective cohort</td>
<td>116 possible UTI episodes in patients with a Foley catheter at the Minneapolis VA Medical Center (2008-09) -symptomatic (n=21) -asymptomatic (n=95) Dedicated FC nurse performed rounds 5 days per week in IP units and at the extended care center Traumatic FC-associated complications = pain, gross hematuria, incidentally noted FC migration and overt mechanical trauma -response to event = intervention or no intervention UTI episodes = UA/UC surveillance; categorized as symptomatic or asymptomatic (CDC criteria for S-UTI and ABU; 2002)</td>
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<td>Manalo et al., 2011, BMC Medical Education</td>
<td>To assess the knowledge and practices of medical interns relating to urethral catheterization and iatrogenic urethral injury secondary to traumatic catheter insertion</td>
<td>Cross-sectional survey</td>
<td>225 first year medical interns (94% response rate) at a tertiary national university hospital in the Philippines in 2010</td>
</tr>
<tr>
<td>Subramanian et al., 2016, Patient Safety in Surgery</td>
<td>To raise awareness regarding urethral trauma in patients with spinal cord injuries as a result of inflating the balloon of a Foley catheter in the urethra during catheterization</td>
<td>Retrospective case series</td>
<td>5 patients with spinal cord injuries at a single institution in the UK (2012-15) -detected when patients visited the spinal injuries center (outpatient) Spinal cord injury patients are at increased risk of urethral trauma from intra-urethral Foley catheter balloon inflation due to: -lack of sensation in the urethra -urethral false passage due to previous trauma -urethral sphincter spasms -altered anatomy due to past surgeries Authors call for an end to the clinical “habit” of using patients with spinal cord injuries for practicing clinical skills by student nurses and</td>
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Non-Experimental/Observational Studies (case-control, cohort, cross sectional, longitudinal, descriptive, epidemiologic, case study/series, survey) |
- Insufficient sample size |
- Sample not representative of patients in the population as a whole |
- Variables (confounders, exposures, predictors) were not described and accounted for |
- Outcome criteria not objective or were not applied in blind fashion |
- Insufficient follow-up, if applicable |
- For diagnostic study, gold standard not applied to all patients |
- For diagnostic study, no independent, blind comparison between index test and gold standard |
- Any modifications made to the intervention were not based on pilot studies |
| Sullivan et al., 2015, Surgeon | To assess the impact of a structured training program in urethral catheterization for junior doctors on non-urological teams on rates of iatrogenic catheter morbidity | Retrospective observational (pre-post) | 1589 adult male patients with urinary catheters before and after introduction of a structured urethral catheterization (UC) program at an academic medical center in Ireland Pre: (n=864; 2006-07) Post: (n=725; 2010-11) Excluded: UC within the urology department, UC by urological team members; UC in the accident and emergency department, outpatient department and operating theatre; patients with indwelling urethral catheters that required a change of catheter Questionnaire set to junior doctors to assess the training program | There was a significant decrease in UC-related complications following implementation of the structured program (pre:6% vs post:4%, p<0.05) Post-intervention: -the most common complication was urethral trauma (55%) -45% of patients developed visible hematuria -41% of traumatic catheterizations occurred during on call hours (5pm-8am) Questionnaire (67% response rate): -agreement that practical training in UC was satisfactory was significantly higher after implementation of the structured program (pre:40% vs post:70%, p<0.01) -there was a significant increase in satisfaction with theoretical training in UC (pre:16% vs post:53%, p<0.01) -confidence in performing UC was also significantly higher after the implementation of the structured program (pre:35% vs post:63%, p<0.02) | Study Limitations = None Non-Experimental/Observational Studies (case-control, cohort, cross sectional, longitudinal, descriptive, epidemiologic, case study/series, survey) Insufficient sample size ✗ Sample not representative of patients in the population as a whole Variables (confounders, exposures, predictors) were not described and accounted for ✗ Outcome criteria not objective or were not applied in blind fashion Insufficient follow-up, if applicable ✗ For prognostic study, sample not defined at common point in course of disease/condition ✗ For diagnostic study, gold standard not applied to all patients ✗ For diagnostic study, no independent, blind comparison between index test and gold standard ✗ Any modifications made to the intervention were not based on pilot studies Quality Improvement (pre-post, controlled pre-post, historical comparison, time series) Intervention not evidence-based Improvement method was not clearly identified or the need for improvement was not described Stakeholders, organizational
| Thomas et al., 2009, BJU International | To examine the magnitude of potentially avoidable iatrogenic complications of male urethral catheterization (UC) | Retrospective case series | 51 adult male patients with complications from urinary catheterization at tertiary care hospital in Ireland (2007-06) - due to UC by non-urological teams
Excluded: UC within the urology department, UC by urological team members; UC in the accident and emergency department, outpatient department and operating theatre; patients with indwelling urethral catheters that required a change of catheter
UC-related morbidity included:
- urethral trauma (68%)
- gross hematuria (39%)
- false passage (31%)
- UTI/urosepsis (15%)
- urethral stricture (2%)
- paraphimosis (17%)
Questionnaire to interns regarding training | 74% of UC-related morbidity resulted from interns performing UC
- 23% by senior house officers (resident)
- 2% by registrar (specialist)
71% occurred within the first 6 months of intern training - on average there was a decrease in one traumatic UC per 2 months, over time (p < 0.001)
- 76% occurred while unsupervised during on-call hours (5pm-8am)
Questionnaire:
- 88% of interns felt their practical training was none or inadequate
- 80% felt their theoretical training was inadequate
- 52% received no supervision during their first UC | Study Limitations =
- None
- Non-Experimental/Observational Studies (case-control, cohort, cross sectional, longitudinal, descriptive, epidemiologic, case study/series, survey)
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REFERENCES


Appendix A: GRADE criteria for rating a body of evidence on an intervention
Developed by the GRADE Working Group

**Grades and interpretations:**
- **High:** Further research is very unlikely to change our confidence in the estimate of effect.
- **Moderate:** Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.
- **Low:** Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.
- **Very low:** Any estimate of effect is very uncertain.

**Type of evidence and starting level**
- Randomized trial—high
- Observational study—low
- Any other evidence—very low

**Criteria for increasing or decreasing level**

**Reductions**
- Study quality has serious (−1) or very serious (−2) problems
- Important inconsistency in evidence (−1)
- Directness is somewhat (−1) or seriously (−2) uncertain
- Sparse or imprecise data (−1)
- Reporting bias highly probable (−1)

**Increases**
- Evidence of association† strong (+1) or very strong (+2)
- Dose-response gradient evident (+1)
- All plausible confounders would reduce the effect (+1)

†Strong association defined as significant relative risk (RR 2-5 or 0.5-0.2) based on consistent evidence from two or more studies with no plausible confounders;
Very strong association defined as significant relative risk (RR >5 or <0.2) based on direct evidence with no threats to validity