# Lower Genitourinary Foreign Bodies: An Institutional Experience and Description of a Novel, Minimally-invasive Extraction Technique for Anterior Urethral Objects

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**OBJECTIVE** To describe our experience with management of lower genitourinary foreign bodies (FBs); to introduce our novel, but simple and minimally-invasive retrieval method compared with standard techniques for anterior urethral FBs; and to propose a derived, practical management algorithm.

**METHODS** We reviewed all male patients presenting with inserted urethral and/or bladder FBs between January 2000 and October 2018. Patient characteristics and number of episodes were identified. Episodes were stratified by FB type, FB location, diagnostic modality, and removal method. We performed a subgroup analysis of anterior urethral FB management techniques comparing retrieval outcomes using our novel Retrieval of Anterior urethral Materials Safely (RAMS) technique which utilizes urethral hydrodistension via retrograde injection of lidocaine jelly to expel FBs vs forceps extraction. Cost analyses were performed, and a management algorithm was then derived.

**RESULTS** We identified 116 episodes. Eighty-seven of 116 (75%) episodes involved items located within the anterior urethra. A subset of episodes (14/116, 12%) was managed using the RAMS technique. There was no difference in FB extraction success rates between RAMS (13/14, 92.9%) and forceps extraction (37/40, 92.7%), $P = 1.00$. FBs were successfully removed using RAMS when utilized for nonembedded FBs located entirely within the anterior urethra. Among FBs located within the anterior urethra, the median total hospital cost was nearly 10 times less with utilization of RAMS compared with cystoscopic extraction ($379.09 v s$3,214.21, $P < .05$).

**CONCLUSION** Because an overwhelming majority of FBs are located within the anterior urethra, the RAMS technique represents a simple, cost-conscious, and minimally-invasive strategy with low risk and potentially high-yield for initial extraction in the emergency department. UROLOGY 128: 96–101, 2019. © 2019 Elsevier Inc.

Urethral foreign body (FB) insertion is a rare condition widely described in the form of case reports.[1-3] Most notably, removal of these objects may present a challenge due to the wide variability of emergency department (ED) presentations.[4] Various motivations, objects, and removal techniques have been previously detailed; however, very few studies have examined these features on a large institutional scale.[1,5-11] Considerable morbidity may be consequent to urethral FB insertion(s) or even the interventions required for removal.[9,10,12] Furthermore, there may be significant costs associated with management of this condition in the form of diagnostic work-up, equipment, and operating room time. Given this, there is a benefit in exploring minimally-invasive and low-cost techniques; however, no efficient manual extraction techniques have previously been described. Therefore, the aims of this study were to review our institution's experience with management of lower genitourinary FBs; to introduce our novel, but simple and minimally-invasive retrieval method compared with standard techniques for anterior urethral FBs; and to propose a derived, pragmatic but cost-conscious management algorithm.

## MATERIALS AND METHODS

### Patient Selection

We performed a single-institution retrospective analysis of all male patients presenting with inserted and retained urethral and/or

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bladder FBs between January 2000 and October 2018 identified by ICD 9 and 10 diagnosis codes. Patient characteristics and presenting symptoms were identified. The episodes were then stratified by the FB type, FB location, diagnostic modality, method of removal, and cost-analysis. Furthermore, we performed a subset analysis of management techniques utilized during episodes involving items identified only within the anterior urethra.

### Removal Algorithm and Technique

We recently developed the Retrieval of Anterior urethral Materials Safely (RAMS) management algorithm (Fig. 1) and technique (Fig. 2**A**), a novel yet simple and minimally-invasive initial method for extracting urethral FBs. The FB must first be suspected or confirmed (ie via patient report, palpation, or imaging) to be located entirely within the anterior urethra which we defined as distal to the external sphincter. While the patient is in the supine position, the penis is initially extended on stretch as 10-20 mL or more (depending on the size of the phallus) of 2% lidocaine jelly is administered via the meatus into the urethra. We prefer utilizing delivery systems such as the Uro-Jet (Amphastar Pharmaceuticals, Inc., Rancho Cucamonga, CA) for its ease of use particularly in this setting. Immediately following administration, the meatus is held firmly closed for 5-10 seconds to facilitate intraurethral pressure development and hydrodistention of the urethra, allowing the FB to be mobilized. The meatus is then released, and the FB typically emerges from the meatus within 30 seconds as the lidocaine jelly is expelled. Concurrent firm pressure can also be applied to the perineum and distally along the urethra to further facilitate FB expulsion.

### Cost Analysis

Available hospital total (direct + indirect) charge cost data for materials/units and episode encounters were collected. Associated costs for various aspects of management were also determined. These data were then adjusted for inflation and reported in year 2018 equivalents using Bureau of Labor and Statistics data (http://www.bls.gov/data/inflation_calculator.htm). A subgroup analysis was performed which examined these costs as related to management of FBs within the anterior urethra.

### Data Analysis

Data were presented as descriptive statistics including frequencies and proportions for categorical variables. Medians with interquartile range were reported for continuous variables. Fisher's Exact test was used to compare categorical variables. Cost analysis between management techniques was performed using the Kruskal-Wallis test. Analysis was performed using Graph Pad Prism 6.0 (GraphPad Software, Inc., La Jolla, CA).

## RESULTS

We identified 23 men with initial median age 29 (range 9-76) years old presenting to the ED with urethral and/or bladder FBs. Of these 23 patients, 19 (83%) were inmates and had a median number of 4 (interquartile range 1-6) episode presentations. Thirteen of 23 (57%) patients had a prior history of FB ingestion and 16 (70%) had a previous diagnosis of mental or psychiatric illness as detailed in Table 1A. Over half (13 of 23) of patients required urethral instrumentation for FB removal and 8 of 23 (35%) were found to have urethral stricture disease at some point during the course of their institutional care. The rate of repeat presentation was 78% (18 of 23).

Among these patients, there were a total of 116 episodes of inserted FBs. Of these 116 episodes, 66 (57%), 23 (20%), and 15 (13%) presented with urinary retention, dysuria or pelvic pain, and hematuria, respectively (Table 1B). Of the 45 (39%) episodes that underwent imaging, 36 (80%) involved the use of pelvic X-ray. Eighty-seven of the 116 (75%) episodes involved items located entirely within the anterior urethra.

At the time of this review, a subset of episodes (14 of 116, 12%) had been managed with the RAMS technique (Fig. 2**B**).

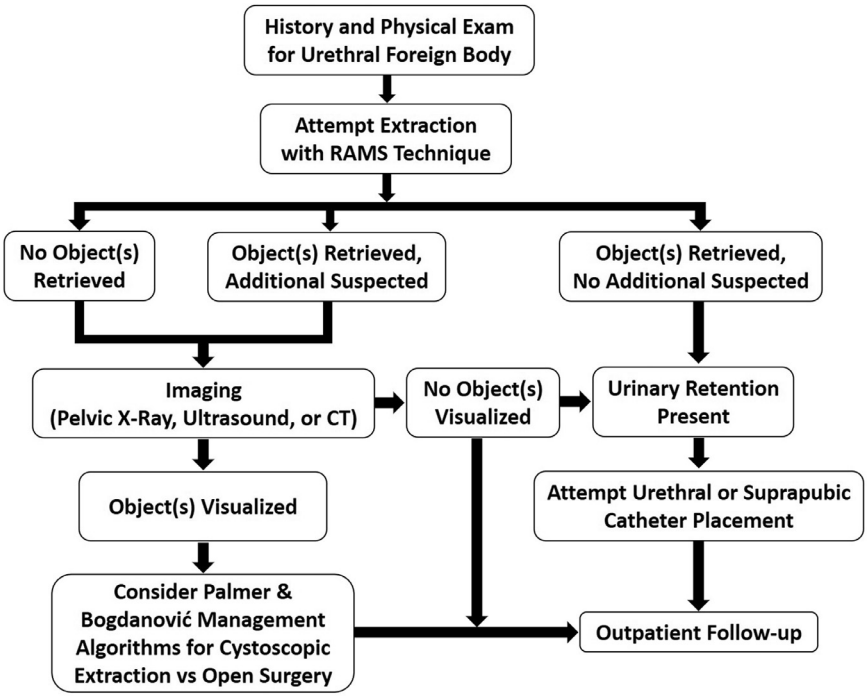


**Figure 1.** Retrieval of Anterior urethral Materials Safely (RAMS) management algorithm.

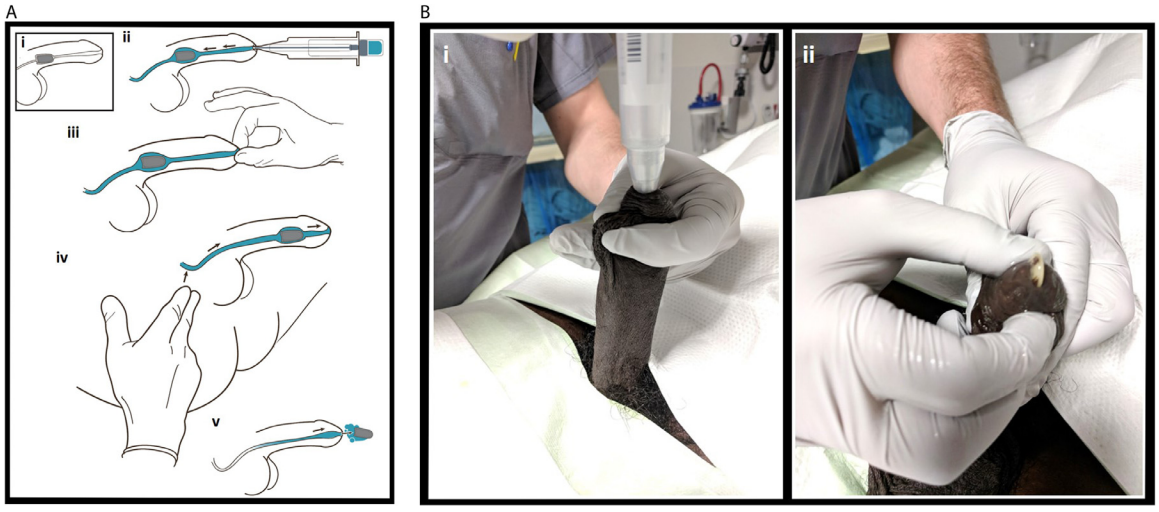


**Figure 2.** (**A**) Depiction of the Retrieval of Anterior urethral Materials Safely (RAMS) technique. (i) Foreign body (FB) located within anterior urethra. (ii) Lidocaine jelly is injected into the urethra while the penis is held on stretch. (iii) The urethral meatus is then firmly closed for ~5 seconds while the jelly causes hydrodistension of the urethra. (iv) Perineal pressure may be applied to help facilitate mobilization of the FB. (v) Subsequent expulsion of the FB with lidocaine jelly. (Illustration created by Mary Beatty-Brooks, Hunter Holmes McGuire VA Medical Center, Richmond, VA.) (**B**) Demonstration of the RAMS technique. (i) Lidocaine jelly is injected into the urethra while the penis is held on stretch. (ii) Subsequent expulsion of the foreign with lidocaine jelly. (Color version available online.)

Among this subset, 6 of 14 (43%) underwent imaging (pelvic X-ray) and all FBs were successfully extracted with RAMS when utilized for objects that were not embedded within the urethra and were located only within the anterior urethra (n = 13). Of note, there was 1 case in which the RAMS technique was unsuccessful because the object (razor blade) was later found to be embedded into the urethra during endoscopic evaluation. Forty-four of 116 (40%) episodes were resolved using blind forceps extraction and another 44 (40%) required cystoscopic removal with graspers (Fig. 3). There was no difference in rate of successful extraction between RAMS (13 of 14, 92.9%) and forceps

**Table 1A.** Patient characteristics

| Variable | Median (IQR) or n (%) |
|---|---|
| Number of patients | 23 |
| Median initial age, years | 29 (25-38) |
| Median last age, years | 33 (27-40) |
| Median number of episodes per patient | 4 (1-6) |
| Incarcerated | 19 (82.6) |
| History of mental illness | 16 (69.6) |
| Schizophrenia or schizoaffective d/o | 8 (34.8) |
| Bipolar d/o | 5 (21.7) |
| Depression | 6 (26.1) |
| Borderline personality d/o | 3 (13.0) |
| Post-traumatic stress d/o | 1 (4.3) |
| Antisocial personality | 1 (4.3) |
| Munchausen | 1 (4.3) |
| Oppositional defiant d/o | 1 (4.3) |
| Adjustment d/o | 1 (4.3) |
| Unspecified | 8 (34.8) |
| History of FB ingestion | 13 (56.5) |
| Repeat urethral FB insertion | 18 (78.3) |
| Required urethral instrumentation | 13 (56.5) |
| Required open surgery | 6 (26.1) |
| Urethral stricture | 8 (34.8) |

d/o, disorder; FB, foreign body; IQR, interquartile range; n, number.

**Table 1B.** Episode characteristics

| Variable | n (%) |
|---|---|
| Number of episodes | 116 |
| Symptoms | |
| Urinary retention | 66 (56.9) |
| Dysuria or pelvic pain | 23 (19.8) |
| Hematuria | 15 (12.9) |
| Penile discharge | 9 (7.8) |
| Imaging | 45 |
| X-ray | 36 (80) |
| CT | 8 (17.8) |
| Ultrasound | 1 (2.2) |
| Location | |
| Anterior urethra | 87 (75) |
| Posterior urethra | 4 (3.4) |
| Bladder | 12 (10.3) |
| Unspecified | 13 (11.2) |
| Retrieval method | |
| RAMS | 14 (12.1) |
| Forceps extraction | 44 (37.9) |
| Cystoscopy with graspers | 44 (37.9) |
| Open surgery | 6 (5.2) |
| Unspecified | 8 (6.9) |
| Retrieved objects | |
| Plastic utensils | 40 (34.5) |
| Metals & wires | 25 (21.6) |
| Rubber, fabrics, other plastics | 19 (16.4) |
| Pen components | 16 (13.8) |
| Cardboard, magazine, paper, styrofoam | 10 (8.6) |
| Catheter fragments | 4 (3.4) |
| Other | 16 (13.8) |

RAMS, Retrieval of Anterior urethral Materials Safely.

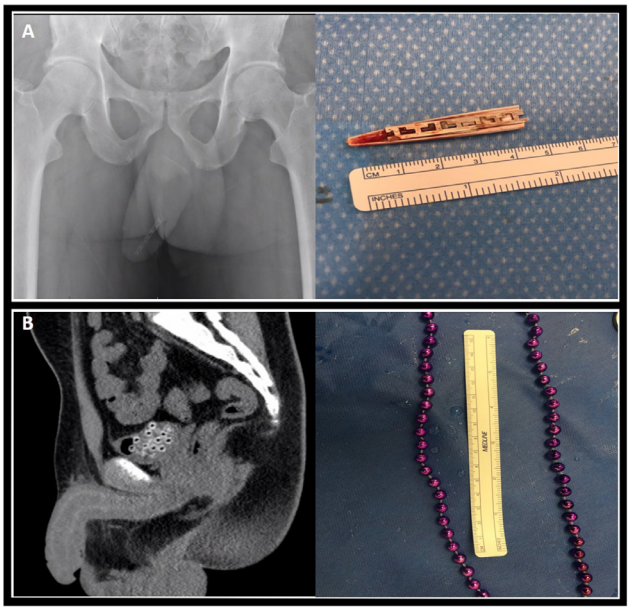


**Figure 3.** Retrieved genitourinary foreign bodies: (**A**) pelvic radiographic imaging revealing plastic spoon fragment affixed to a razor blade which was found within the distal penile urethra and was successfully managed with manual extraction. (**B**) CT imaging (sagittal plane) revealing a beaded necklace which was found within the urinary bladder and was successfully managed with cystoscopic extraction. (Color version available online.)

(37 of 40, 92.5%) extraction techniques, $P = 1.00$. Six of 116 (5%) episodes required open surgical management with cystotomy or urethrotomy.

The FBs extracted during episodes varied widely (Table 1B). In 40 of the 116 (34%) episodes, extracted items were segments of plastic utensils. The next most common (25 of 116, 22%) FBs encountered were various metals and wires. Of the 116 episodes, 19 (16%) involved items composed of rubber, fabrics, or other plastics while 16 (14%) involved pen components.

Elements of hospital total charge costs are provided in Table 1C. Subgroup analysis of FBs located within the anterior urethra revealed that the median total encounter charge cost was nearly 10 times less with utilization of the RAMS technique/algorithm compared to cystoscopic extraction.

## DISCUSSION

To our knowledge, this study represents the largest retrospective review of urethral FB insertion episodes. In addition, we developed a management algorithm and performed a subset analysis of patients treated with our newly described RAMS technique which offers a simple, minimally invasive, and cost-conscious method for removing urethral FBs.

In this evaluation, we identified and characterized urethral FB management at our institution. Although this patient population is small, there is a considerable rate of repeat presentation as demonstrated by the 116 episodes that presented at this institution. Interestingly, the vast majority of FBs were found to be entirely within the anterior urethra. Despite this, most objects were extracted blindly with forceps or cystoscopically. Use of the RAMS technique could potentially decrease utilization of these other removal methods and their associated costs, as well as decrease the rate of iatrogenic injury from extraction.

The presentation and management of urethral FB have been described in various case reports and retrospective reviews.[1,2,4,9,10,12] Ophoven and DeKernion presented the first expansive historical literature review of genitourinary FBs, noting that the removal method was largely dependent on object size and mobility.[4] Furthermore, they advocated the use of endoscopic and minimally invasive removal techniques when possible.[4] Following this, Rahman et al detailed a single-center experience with FB management, primarily using endoscopic retrieval.[10] Palmer et al presented the first management algorithm,

**Table 1C.** Hospital total charge costs

| Extraction Technique | Median Total Encounter Costs (IQR) | *P* value |
|---|---|---|
| RAMS | $379.09 (251.31-695.58) | |
| Forceps | $659.41 (327.67-4606.81) | .012* |
| Cystoscopic | $3214.21 (2415.24-3687.20) | |
| **Variable** | | **Median total unit/material costs** |
| Stay costs | | |
| Daily hospital admission | | $1411.14 |
| Emergency department visit | | $256.05 |
| Operating room utilization | | $2067.61 |
| Radiology | | |
| Pelvic X-ray | | $55.00 |
| Pelvic ultrasound | | $178.55 |
| Pelvic CT | | $268.69 |
| Management | | |
| RAMS (Urojet lidocaine jelly) | | $17.46 |
| Forceps | | $1.47 |
| Cystoscopic extraction | | |
| Outside operating room | | $230.76 |
| Inside operating room | | $2643.26 |

* Determined using Kruskal-Wallis test.

which recommended manual extraction for FBs that were small (≤1 cm), palpable, mobile, distally-located, and not involving gross hematuria. Imaging followed by invasive management options was recommended if the object did not meet these criteria. Interestingly, endoscopic management with attempted forceps/grasper extraction was indicated if the item was mobile and isolated only within the urethra, while open surgical removal was recommended in the presence of bladder involvement or if the object was found to be immobile on cystoscopy.[9] Bogdanović et al later modified this algorithm by enhancing the range of endoscopic management options by considering urethral caliber relative to object size among FBs with a significant bladder component as well as laser utilization for impacted FBs prior to progression to open surgical intervention.[13]

The experience at our institution is not dissimilar from these previous studies. We observed a high rate of mental and psychiatric diagnoses among these patients.[5,9,10] Furthermore, we identified concurrently high rates of other FB insertion behaviors (ie ingestion). However, in contrast to previous reports, the most common presenting symptom was urinary retention rather than dysuria or pelvic pain. [9,10] Additionally, we found that the motivations and rationales for insertion appeared to be primarily opportunistic rather than autoerotic in nature, likely due to our patient population.[4] This may be explained in part by the relationship shared between our institution and the state Department of Corrections, and the consequently high proportion of patients presenting as inmates.

Palmer et al successfully utilized manual extraction (via use of extrinsic distal urethral pressure) in 54% of their cases.[9] Although it is unclear how many unsuccessful attempts were made to manage cases in this manner, this agrees with our finding that a significant proportion of FBs were located within the anterior urethra. We previously utilized forceps for the extraction of FBs; however, this somewhat unreliable approach is virtually blind, thereby increasing the risk of urethral injury.

The RAMS algorithm and technique represent a safe, simple, and cost-conscious initial method for extraction of suspected anterior urethral objects. The development of this technique came about somewhat serendipitously following recognition of the high utilization rates of forceps and endoscopic management approaches in addition to the increased time and resources (eg imaging, instruments, and operating room costs) associated with them. Compared to these more invasive management options, the potential benefits of the RAMS technique include decreased patient discomfort (and consequently, opioid analgesic requirements), procedure encounter duration, and likelihood of iatrogenic urethral injury. Additionally, RAMS is not necessarily limited to the palpability or size of the FB, which have been proposed components for proceeding with manual extraction in the Palmer and Bogdanović management algorithms.[9,13]

Notably, we found that nonpalpable, abstract objects such as cardboard, magazine/paper, and fabrics were more readily spontaneously expelled likely consequent to their physical properties. Furthermore, objects up to 5-6 cm in length could be spontaneously expulsed. In extraction of longer objects up to 10 cm, we found that manual perineal urethral pressure with distal progression was necessary to facilitate extrication. These features highlight the versatility of this extraction technique which may greatly expand upon the criteria established by these previously described algorithms. Because the majority of objects were found within the anterior urethra and consequently had a higher likelihood of successful evacuation with use of this technique, initiating this strategy as a preliminary step in management may obviate the need for imaging and potential radiation exposure. The simplicity and ease of the RAMS technique strengthens its capacity for potential utilization by ED physicians, who may otherwise initially attempt to manage these situations using forceps, and thereby avert the need for urologic consultation. Although limited cohort sizes, there was no difference in the rate of successful FB retrieval with RAMS compared to forceps extraction, suggesting that it may be as effective yet clearly less invasive and traumatic. Despite the lower unit charge cost of forceps compared to lidocaine jelly, encounter costs that involved extraction with the former were notably higher likely due to use of additional associated resources such as analgesia/anesthesia, antiseptics, antibiotics, etc., which are often unnecessary when using the RAMS approach. Therefore, this currently proposed algorithm may potentially decrease the burden and total costs associated with utilization of potentially unnecessary resources.

In our experience, any inserted items contained entirely but not embedded within the anterior urethra were retrieved successfully with the RAMS technique. Certainly, this study and technique are not without limitations. First, this investigation is inherently limited by its retrospective nature. Second, evacuation of items with multiple components (eg wiring/cables), considerable complexity (eg tissue embedded/impacted), extensive length, involvement beyond the anterior urethra, or in the setting of an incompetent external sphincter may prove difficult. However, even if unsuccessful, the RAMS technique does not preclude or prevent the progression to more invasive options (ie cystoscopic extraction) if warranted. Although our proposed algorithm is a derivation based on a pragmatic, cost-conscious approach involving the RAMS technique, further evaluation is warranted. Finally, we should note that the presence of symptoms such as gross hematuria or identification of urethral stricture disease may warrant further evaluation and work-up in the outpatient setting.

## CONCLUSION

Urethral FB insertion is a unique and uncommon condition with commonly high rates of repeat presentation. The assorted motivations and factors behind this behavior may be influenced by the patient population and characteristics; however, further evaluation is necessary. Various algorithms exist that may inform management of FBs. Because an overwhelming majority of FBs are found

within the anterior urethra, the RAMS management algorithm and technique represent a simple, cost-conscious, and minimally-invasive initial strategy with low risk and potentially high-yield for extraction in the ED.

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