Difficult Catheterization: Tricks of the Trade

Learning Objective: At the conclusion of this continuing medical education activity, the participant will recognize the most common causes of difficult urethral catheterization in the male and understand the rationale behind a stepwise approach to correcting it.

Carlos Villanueva, M.D.

Disclosures: Nothing to disclose

and

George P. Hemstreet III, M.D., Ph.D.

Disclosures: Nothing to disclose

Department of Surgery, Division of Urology
University of Nebraska Medical Center
Omaha, Nebraska
INTRODUCTION

Difficult urethral catheterization is a common urological problem. It is challenging to estimate the exact percentage of difficult catheterizations as it depends on the knowledge and skill of the individual performing the catheterization. Urology residents in the United States are subjected to a variable incidence with regard to the number of DUC cases they encounter, since it is interdependent on the experience of the nurses and size of the hospital. Figure 1 depicts the weekly frequency that residents dealt with DUC derived from an unpublished online survey we performed.

ETIOLOGY

Difficult female urethral catheterization is primarily due to vaginal atrophy with retraction of the urethral meatus into the vagina. To overcome this problem, placing the patient in the lithotomy position, using a speculum or guiding the catheter blindly with the index and middle fingers usually achieves a successful catheterization. Strictures and DUC unrelated to vaginal atrophy are rare in females and, therefore, we will focus solely on male DUC.

The causes of DUC depend in large part on the definition of DUC. Most studies have defined DUC as the inability by nurses, other physicians and urologists to pass any Foley (coudé, regular, silicone) catheter into the bladder before using more invasive techniques (filiforms/followers, flexible cystoscopy, glide wires etc.). In other words, most previous studies have not considered a urethral catheterization difficult when a urologist successfully catheterizes a patient using an 18Fr coudé after a nurse was unable to place a 16Fr regular catheter. Using this traditional definition, the most common cause of DUC is urethral stricture disease followed by bladder neck contracture and false passage. Other important causes of DUC not yet mentioned are related to difficulty gaining access to the urethral meatus because of phimosis, meatal stenosis, morbid obesity or advanced penile cancer.

SCOPE OF THE PROBLEM

DUC invokes significant stress on patients. At our institution a mean of 1.6 nurses (range 0 to 4) attempt urethral catheterization, each with 1 or more catheters before consulting a urologist. Most of these patients are awake and undergo attempted catheterizations without local or systemic analgesia. Many unsuccessful catheterizations result in urethral trauma. Catheters can be pushed forcefully against strictures creating false passages and significant bleeding. Foley balloons are frequently inflated in the urethra since some nurses are instructed to inflate the balloon once urine is seen, which may occur when the tip of the Foley is in the bladder but the balloon is in the urethra. The ensuing urethral trauma then results in prolonged hospitalization, increased health care costs, urethral strictures etc. When trauma occurs in the setting of a urinary tract infection or anticoagulation, the consequences can be sepsis and bleeding, sometimes requiring transfusion.
FIG. 2. Most common causes of difficult urethral catheterization

Chavez et al estimated the costs of traumatic urethral catheterization based on a retrospective study of medical records from 1998 to 2007 using ICD-9 codes. Of a calculated 221,045 catheters placed during the study period 3101 patients had Foley catheter related trauma (1.4%). The incidence of urinary tract infection, cystitis and septicemia 2 weeks after urethral injury was 12.72%, 3.45% and 1.9% with estimated costs of $11,052, $482 and $48,935, respectively. A total of 1020 patients (32.87%) underwent a corrective surgical procedure following the urethral injury.

Thomas et al concluded that urethral catheter related iatrogenic morbidity is not uncommon even at tertiary care center teaching hospitals. In their study 51 of 864 urology consultations (6%) in 1 year were the result of problems secondary to urethral catheterization. A Foley balloon was inflated in the urethra in 6 cases and urethral trauma was identified in 35. These results indicate that most complications are potentially avoidable and can be prevented by adopting a proper technique.

Occasionally urologists compound patient urethral trauma and discomfort by instrumentation with catheter guides, filiforms/followers, glide wires etc. Patients undergo many of these procedures awake without adequate analgesia or sedation. Although underreported in the literature for obvious reasons, cases of rectal perforation from the use of followers or Heyman dilators are not unheard of and Fournier gangrene has also been reported after DUC.

DIFFERENT APPROACHES TO DUC

Before the invention of flexible cystoscopes and glide wires, urologists relied on filiforms/followers, catheter guides, urethrograms/fluoroscopy and different catheters for DUC. The most popular approaches among residents based on our online survey are summarized in Appendix 1. Many other techniques not shown in the Appendix include using rigid ureteroscope inside a Foley, peel away sheaths, super stiff glide wire inside a Foley, hydrophilic catheters and forceful saline irrigation. These techniques have been summarized in the literature.

RECOMMENDED APPROACH TO DUC

When approaching a case DUC, it is important to obtain a thorough history, perform a physical examination and follow a stepwise, evidence-based approach to placement of the catheter using the less invasive maneuvers first followed by more invasive maneuvers and, when necessary, placing a suprapubic catheter.

History and physical examination. Past urological surgeries (ie prostatectomy, urethroplasty etc), previous episodes of DUC and voiding symptoms provide an etiological clue to the problem. Historical information pertaining to previous attempts by nurses or physicians (number and type of catheters tried) is of the utmost importance and may be used to determine whether the problem is distal or proximal in the urethra. If blood is present at the meatus, it is important to ascertain if the bleeding was caused by previous urethral catheterization attempts. Bleeding after previous attempts due to catheter trauma or a balloon inflated in the urethra can signal the possibility of a false passage. Problems such as penoscrotal edema, phimosis, penile cancer and meatal stenosis can be readily identified on physical examination. A rectal examination can unveil advanced prostate or rectal cancer.

The hospital location for patients undergoing catheterization is an important consideration. Intraoperative consults are different from DUC on the floor/emergency room because the urethral sphincter is related in patients under anesthesia. A low threshold for cystoscopy should be maintained in patients under anesthesia since definitive surgery may be considered at that time if a small stricture or bladder neck contracture is diagnosed.

Patient preparation and basic technique. When DUC is anticipated, it is preferable to prep the penis, scrotum, suprapubic area and upper thighs with an antiseptic (povidone-iodine or chlorhexidine), and drape the patient down to cover the legs and feet with a 3/4 sheet drape to be better prepared for cystoscopy, glide wires and a suprapubic catheter if needed.

Lubrication is of paramount importance during DUC. It is estimated that the average volume of the male urethra is 20 ml, and so injection of at least 10 ml of lubricant into the urethra should be standard technique. Whether 2% lidocaine jelly provides additional benefit over plain jelly was questioned in a meta-analysis. If the patient can derive some placebo effect from knowing he is receiving “numbing jelly,” the practitioner may consider using it.

Several relevant details regarding the technique of urethral catheterization require emphasis. It is important to advance the catheter by itself, without having it connected to collection bags or syringes, which allows for the best tactile feedback that would signal the presence of
a false passage, stricture or a tight sphincter. The penis should be held at a 45-degree angle with the non-dominant hand aided with gauze, making sure to avoid contamination with lubricant. The dominant hand should advance the catheter and must be free of lubricant at all times to enhance the tactile feedback.

**Choice of initial catheters.** When 1 or more nurses are unable to place a catheter, we recommend starting with an 18Fr coude. A recent survey of U.S. urology residents determined that the **18Fr coude catheter** is most commonly used in the setting of DUC. It should work for BPH, incorrect technique (lack of lubrication etc) and an anxious patient with a tight sphincter. As mentioned previously, in 65 consecutive consults for DUC at a university and private hospital 30 patients (46%) were readily catheterized with a 16 to 18Fr coude catheter.

When unable to place an 18Fr coude, we recommend attempting to pass a 12Fr silicone catheter. After BPH and incorrect technique are excluded, strictures and bladder neck contractures are the most common causes of DUC. Therefore, it is reasonable to use a small catheter. The problem associated with using a 12Fr coude or a 12Fr latex catheter (instead of the 12Fr silicone catheter) is that both are flimsy and sometimes bend from the friction on the urethra. These flimsy catheters are also more likely to coil and give the impression that the catheter is all the way into the bladder with the potential of inflating a balloon inside the urethra. However, the 12Fr silicone catheter is stiff, and can be advanced through medium sized strictures and bladder neck contractures. This catheter alone was successful in 17% of the private DUC consults in our series. Our experience with combined use of an 18Fr coude catheter and a 12Fr silicone catheter for DUC resulted in success rates of 58% and 66.5% at the university and private settings, respectively.

**FLEXIBLE CYSTOSCOPY AND THE BLIND GLIDE WIRE TECHNIQUE**

If a urologist attempted use of the 2 aforementioned catheters unsuccessfully, a more advanced technique should be pursued. We prefer to attempt placement of a glide wire blindly, although most urologists would agree that flexible cystoscopy is the standard of care. Because of its ease and safety as well as the potential of cost and time savings of blind glide wire placement, we only perform cystoscopy when unable to advance the glide wire into the bladder safely. It is worth noting that, although well supported in the literature (Appendix 1), blind passage of a glide wire when a cystoscope is readily available is probably considered controversial by many urologists.

While generally easy, the advancement of a glide wire blindly into the bladder requires skill and knowledge. The average length of the adult male urethra is 22.3 cm (15 to 29). The glide wire used should be hydrophilic, 0.89 mm in diameter and usually 150 cm long. Stiff or super stiff glide wires must always be avoided because of the potential for bladder undermining, worsening a false passage or bladder perforation. Straight or curved tips of glide wires can be tried, with no evidence suggesting one is better than the other.

After wetting the wire, the penis is grasped as when placing a catheter and the dominant hand advances the glide wire gently. If there is a false passage or a tight stricture that prevents negotiation of the glide wire, the tip of the glide wire usually comes right back to the urethral meatus as long as a stiff glide wire is not used. When this occurs, the maneuver should be repeated 2 or 3 times and use of the glide wire with an angled vs straight tip may be considered. When unable to advance the glide wire, we have successfully advanced a Foley catheter to the point of obstruction and then the glide wire along the Foley catheter. When more than 50 cm of glide wire have been advanced into the penis without the tip appearing at the meatus, it can be assumed that the wire is in the bladder.

We prefer to advance the entire length of the glide wire into the bladder and coil it inside until about 30 cm are left outside the penis. This technique almost guarantees that the glide wire is in the bladder and prevents it from inadvertently being pulled out while performing other maneuvers. Alternatively, a plain x-ray can be obtained to confirm glide wire placement (if there is concern for misplacement) or fluoroscopy can be used to assist in the passage of the glide wire into the bladder when available. In our 65 consecutive cases of DUC a glide wire was advanced successfully in 80% in which neither an 18Fr nor 12Fr catheter could be placed, all of which subsequently had catheters placed over the glide wire successfully.

Flexible cystoscopy can be challenging in the setting of DUC. Patients often have suffered trauma to the urethra with active bleeding that interferes with visualization. False passages can be a challenge to navigate. The true lumen of the urethra in cases of false passages secondary to DUC can usually be found anteriorly. If visualization is a problem, the cystoscope should be deflected anteriorly distal to the false passage and then, keeping the anterior urethral mucosa in view, advanced into the bladder past the point of obstruction. Once inside the bladder, a glide wire is advanced through the scope and the scope is removed. If unable to reach the bladder with the flexible cystoscope, an attempt to advance a glide wire into the bladder can be facilitated by the scope by directing the glide wire into a pinpoint stricture, bladder neck contracture or the true lumen of the urethra.

Whether the glide wire was positioned under direct vision using cystoscopy or blindly, it will be used to guide a catheter safely into the bladder. We also like to follow a stepwise approach to placing a catheter over the glide wire. If cystoscopy was performed and no stricture was identified, a 16 to 20Fr coude tip catheter is likely to be easily advanced into the bladder. If the glide wire was placed blindly, a 16Fr coude tip catheter can be tried first. If this catheter encounters resistance, our next approach is to rely on the previously used 12Fr silicone catheter. To advance the 12Fr silicone catheter over the glide wire the tip of the catheter is modified using an 18 gauge angiocath and the Blitz technique (fig. 3). The stiffness of the 12Fr silicone confers to it some of the qualities of a urethral dilator. When placed over a glide wire, it can be advanced through tight strictures as long as the tip modification was completed correctly. In our series only 3 (4.6%) patients underwent dilation with a 10 to 12Fr ureteral access sheath before advancing the 12Fr silicone catheter over the glide wire.

**URETHRAL DILATION AND DUC**

Evidence is accumulating regarding the low success rates of endoscopic approaches to urethral stricture disease. Some now claim that urethral stricture is an open surgical disease. The purpose of dilating a urethral stricture in cases of DUC is to be able to drain the bladder as a temporizing measure before definitive surgical repair of the stricture. Urethral dilation in the awake patient is painful. Urethral dilation using Heyman or filiforms and followers can result in serious trauma, and dilation in the setting of infection or anticoagulation can result in sepsis or severe bleeding.

No one can be faulted for inserting a suprapubic catheter in a case of a urethral stricture after a 12Fr silicone catheter could not be advanced over a glide wire. Alternatively, the urethra can be dilated up to 12 to 15Fr with ureteral dilators, a ureteral access sheath or a balloon dilator followed by placement of the 12Fr silicone catheter over the glide wire, potentially minimizing urethral trauma and avoiding another potentially
dangerous procedure (suprapubic tube placement). Balloon dilators potentially cause less trauma compared to regular ureteral dilators because they exert a controlled radial expansion minimizing the axial forces. **The goal is to dilate the minimal amount that will allow the smallest catheter to provide adequate drainage.**

SUPRAPUBIC CATHETERIZATION

SP catheterization is indicated when either a tight stricture is encountered in a patient who would be a good candidate for urethroplasty or in a completely obliterated urethra when a glide wire cannot be secured in the bladder. **Contraindications for the procedure include coagulopathy and active bladder cancer.** In the case of previous midline abdominal incisions/surgeries one must be cognizant that there is no bowel between the bladder and abdominal wall, and consider using ultrasound guidance or an open approach to placing the SP catheter.

A suprapubic catheter can be placed by open cystotomy or percutaneously. The percutaneous approach is more appropriate in the awake patient with DUC since it can be performed at the bedside. The technique of placing an SP catheter varies according to the SP kit used (Appendix 2). **A distended bladder position can be assessed by palpation, percussion or ultrasonography.** To place a percutaneous SP tube, the bladder needs to be palpable or the procedure needs to be performed under ultrasound guidance. Chiou
et al use a kit that involves localization of the bladder with a needle, which allows for the possibility that if bowel is entered and recognized, a larger hole can be avoided. Other kits that consist of a trocar with a sheath around it have the potential to place a large hole in the bowel during insertion. Some kits allow for the placement of regular Foley catheters while others only allow for the placement of catheters without balloons that need to be secured and taped to the skin, and have the potential to slip out more easily.

**UROLOGY CART**

Most university hospitals have a urology cart that consists of a mobile unit with drawers and a light source with or without a monitor. Although mainly used in cases of DUC, they are also used for clot irrigation. Consequently when stocking these carts, both situations must be considered. We recommend stocking the cart with general items such as povidone-iodine, 4 by 4 gauze, sterile gloves, and operating room drapes and towels etc. For DUC 12Fr silicone, 18Fr coude and 16Fr council tip catheters are necessary. Angled and straight tip 0.89 mm glide wires (avoid stiff glide wires) as well as 16 or 18 gauge angiocaths to be used to modify the catheter tip (Blitz technique) should also be stocked. Ureteral dilators, ureteral access sheaths or urethral/ureteral balloon dilators can be stored in the cart depending on hospital availability of these instruments and the preference of the urologists using the cart. Most important is the cystoscopy equipment (cystoscope, saline for irrigation, cystoscopy tubing, connectors etc) as well as the light source and monitor. A 24Fr 3-way Rusch catheter as well as regular 3-way 20, 22 and 24Fr catheters can be added to the cart to be used for clot retention.

**URETHRAL CATHETER TEAMS**

Some large academic institutions have adopted special teams dedicated to the placement of urethral catheters. The Mayo Clinic has female and male catheterization teams, which place every Foley and perform all intermittent catheterizations, manage continuous bladder irrigation and irrigate obstructed catheters. Anecdotally, the manager of the Mayo Foley team reports Foley trauma to be extremely rare. It is their belief that the catheter team pays for itself because of the decrease in trauma and urinary tract infections, and increased quality of teaching intermittent catheterization. Additionally, nurses can provide better care to their patients by being relieved of this work. The problem with this system for most hospitals is obtaining reimbursement for their services.

Reimbursement for DUC is low. Urologists generally find it is not cost or time effective to leave clinics or lose sleep for a case of DUC. This problem is especially relevant with urologists who do not have residents. Academic urologists rarely deal with DUC, which has pushed some private practices to adopt Foley catheter teams. There is only 1 urology group in Lincoln, Nebraska and the group has no residents. Thus, 3 technicians have been trained to place catheters in patients with DUC. A contract has been arranged with local hospitals and nursing homes for reimbursement for their services. The Foley team is able to successfully place catheters in 95% of the consults. The team has been in place for more than 20 years and the urologists report that their lives are better because of it.

**NEW DEVELOPMENTS AND FUTURE RESEARCH**

Percuvison® (http://www.percuvision.com) is an Ohio based company that developed a Foley catheter with an integrated camera for visually guided catheterizations. They believe that by training nurses in the use of their product, nurses will be able to catheterize patients under direct vision, avoiding urethral trauma, false passages and balloon inflation in the urethra. The 3-way (vision, urine and balloon) 14Fr silicone catheter has disposable sheaths, and is purchased with a video tower. At this point, direct vision catheterization using the Percuvision system has not been compared to other, less expensive alternatives such as nurse education, use of coude catheters and lubrication etc. The company is pursuing further studies of their device. An option would be to reserve Percuvision for only those patients in whom DUC is anticipated based on history or physical examination but this approach would require first demonstrating that the majority of the instances of Foley trauma occurred in patients in whom DUC could have been anticipated. To our knowledge, no study has measured or identified risk factors of DUC and, therefore, it is currently unclear what role the Percuvision device will play in DUC. Further studies are needed.

A study comparing the incidence and costs of urethral trauma at 2 different institutions with and without a Foley catheter team, respectively, could help determine whether the team is cost-effective. This study could prompt insurance companies and hospitals to employ these teams if proven to be cost-effective. Without the data, hospitals are skeptical and not willing to invest in Foley teams. Other studies comparing our proposed DUC algorithm (fig. 4) rather than going directly to flexible cystoscopy are needed to determine if there is time and cost savings to using our algorithm.

**CONCLUSIONS**

DUC is a common problem for urologists which should be addressed in a methodical and organized manner. After obtaining a comprehensive history and performing a focused examination, we recommend following a stepwise approach from least invasive/costly to more invasive/costly maneuvers. The disparities in the approach to DUC among the urological community need to be addressed with further studies. Prevention of urethral trauma secondary to catheterization is of utmost importance, and the role of catheter teams in the prevention of Foley trauma needs to be elucidated.
APPENDIX 1: MOST POPULAR APPROACHES TO DUC AMONG UROLOGY RESIDENTS IN THE U.S

<table>
<thead>
<tr>
<th>Approach</th>
<th>Advantages</th>
<th>Disadvantages</th>
<th>% First Line Approach by U.S. Urology Residents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexible cystoscopy1, 8-10</td>
<td>Direct visualization of the cause of the problem, ability to place guidewire under direct vision</td>
<td>Not always available, cost</td>
<td>62-74</td>
</tr>
<tr>
<td>Blind passage of a glide wire11-14</td>
<td>Easy to perform</td>
<td>Cause of the problem not diagnosed, potential for displacement of glide wire</td>
<td>15-23</td>
</tr>
<tr>
<td>Blind use of filiforms and followers15</td>
<td></td>
<td>Cause of the problem not diagnosed, potential for severe urethral injury and rectal perforation, difficult to use</td>
<td>7-9</td>
</tr>
<tr>
<td>Suprapubic catheter placement</td>
<td>Avoids dilating the urethra, making a future urethroplasty easier</td>
<td>Potential for bowel or bladder injury and bleeding, difficult to perform at bedside</td>
<td>0.7-3.5</td>
</tr>
</tbody>
</table>

APPENDIX 2: SUPRAPUBIC CATHETERIZATION KITS

<table>
<thead>
<tr>
<th>Type of Kit</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seldinger technique:</td>
<td></td>
</tr>
<tr>
<td>Chiu SP tube introducer set23</td>
<td>Chiu kit is the only SP percutaneous kit that allows placement of an 18Fr Foley</td>
</tr>
<tr>
<td>Cook®-Cope Loop Suprapubic Set</td>
<td></td>
</tr>
<tr>
<td>Trocar/sheath systems:</td>
<td></td>
</tr>
<tr>
<td>Cook Suprapubic Catheter Set</td>
<td>Maximum size is 16Fr</td>
</tr>
<tr>
<td>Cook Cystostomy Catheter Set</td>
<td></td>
</tr>
<tr>
<td>Lawrence Add-a-Cath Suprapubic Catheter Introducer</td>
<td></td>
</tr>
<tr>
<td>Trocar-needle/catheter systems:</td>
<td></td>
</tr>
<tr>
<td>Bonnano Suprapubic Catheter Tray</td>
<td>Maximum size is 14 Fr, most of these catheters lack a balloon</td>
</tr>
<tr>
<td>Stamey Percutaneous Loop Suprapubic Catheter Set (Cook)</td>
<td></td>
</tr>
</tbody>
</table>

REFERENCES

1. The average length of the male urethra is
   a. 18 cm
   b. 20 cm
   c. 22 cm
   d. 24 cm
   e. 28 cm

2. The most common cause of difficult urethral catheterization reported in the literature is
   a. Urethral stricture
   b. Prostate cancer
   c. False passage
   d. Bladder neck contracture
   e. Phimosis

3. Which of the following is a reason to avoid urethral dilation in the setting of difficult urethral catheterization?
   a. It can make a future urethroplasty more complicated
   b. It is painful in the awake patient
   c. It can cause severe bleeding or sepsis
   d. Rectal perforation is a possibility
   e. All of the above

4. Which is the correct option in regard to the different approaches to DUC?
   a. Most urology residents in the U.S. resort to filiforms and followers as their first line approach
   b. The blind passage of a glide wire is chosen by 15% to 23% of urology residents as their first line approach
   c. Flexible cystoscopy is chosen by 15% to 23% of urology residents as their first line approach
   d. 12Fr coudé catheter is the most commonly used catheter by urology residents in the U.S.
   e. Urethral sounds are a safe and effective approach

5. Which of the following is correct in regard to the use of 12Fr silicone catheters?
   a. A 0.635 mm glide wire but not a 0.89 mm glide wire can be used in conjunction with a 12Fr silicone catheter
   b. Silicone catheters and latex catheters have the same tendency to buckle
   c. When using a 12Fr silicone catheter, the tip should be cut with scissors to advance the glide wire
   d. A 16-18 gauge angiocath can be used to assist in the passage of a glide wire through the tip of a 12Fr silicone catheter
   e. 12Fr silicone catheters are a good alternative in cases of false passages

Take this test online at http://www.auanet.org/eforms/cme/