

VOLUME 42

AUA

# UPDATE SERIES

2023

LESSON 20

## Surveillance and Management of Long-term Complications of Augmentation Cystoplasty and Catheterizable Channels

**Learning Objective:** At the conclusion of this continuing medical education activity, the participant will be able to conduct routine surveillance of patients with bladder augmentation and catheterizable channels; appropriately order laboratory, imaging, or functional studies; identify common long-term sequelae and complications; and develop treatment strategies.

This AUA Update aligns with the American Board of Urology Module on Neurogenic Bladder, Voiding Dysfunction, Female Urology, BPH, and Urethral Stricture. Additional information on this topic can be found in the AUA Core Curriculum section on Neurogenic Bladder.



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**KEY WORDS:** bladder augmentation, enterocystoplasty, catheterizable channel, neurogenic bladder, bladder reconstruction

## INTRODUCTION

Adults with impaired bladder storage and emptying are classified with lower urinary tract dysfunction (LUTD). Patients may have a dysfunctional capacity, altered compliance, over- or underactive detrusor function, and/or bladder outlet obstruction or incompetence most commonly from neurological or infection/inflammatory etiologies.<sup>1</sup> In the setting of a known neurological condition, these impairments are termed neurogenic lower urinary tract dysfunction (NLUTD).<sup>2</sup> **The goals for all patients with LUTD are to preserve renal function and optimize quality of life.** After failing more conservative measures (ie, medications, botulinum injection, sacral neuromodulation), patients opting for bladder-sparing continent reconstruction may proceed with augmentation cystoplasty (AC) with creation of a catheterizable channel (CC) and often combined with outlet procedures.<sup>3,4</sup> AC is performed for patients displaying small capacity, poor compliance, and/or refractory detrusor overactivity (DO). AC can be performed with small- and large-bowel segments or even gastric tissues.<sup>3</sup> CCs are outstanding options for the appropriate candidate; for example, women on self-catheterization with competent outlets with challenging anatomy making urethral cannulation complicated. They are also options for individuals with benign disease to the urethra or bladder neck who cannot self-catheterize per urethra (ie, radiation, strictures).<sup>4</sup> Various bowel options exist for CCs, including the appendix (Mitrofanoff), ileum (Yang-Monti)/tapered ileum, or ileocecal valve (with cecal augment).<sup>3,4</sup> Bladder outlet procedures should be performed for an incompetent bladder neck and/or sphincter deficiency. Options generally include urethral bulking, artificial urinary sphincter (AUS), bladder neck closure, or an occlusive autologous sling.<sup>3</sup>

**After the acute postoperative period, it is essential to establish long-term urological care.** There are important variables to consider in management, including catheterization regimens, renal function, imaging studies, urinary infections, onset of new symptoms, and diagnoses, as well as emergent issues. **This Update provides guidance for long-term surveillance and management of patients with AC and CCs.**

## ROUTINE CLINIC VISIT

Surveillance is based on presurgical risk category per the AUA guidelines for NLUTD.<sup>5</sup> Low-risk patients are stable, able to void spontaneously, and without urinary symptoms or abnormalities on imaging/lab work (Figure 1).<sup>1</sup>

For individuals with evolving urinary symptoms, risk is further stratified into moderate and high.<sup>5</sup> Moderate-risk patients have normal renal function and imaging but may have an elevated post-void residual as well as abnormalities on urodynamics (DO with incomplete emptying, retention, bladder outlet obstruction). For these patients, annual evalua-

tion is recommended for history and physical, renal function assessment, upper tract imaging every 1-2 years, and repeat urodynamics when there are changes in clinical symptoms or new issues (ie, stones, infections, autonomic dysreflexia).<sup>5</sup>

High-risk patients are individuals with abnormal renal imaging and/or function studies, as well as abnormal and potentially ominous urodynamic findings (ie, poor compliance, detrusor sphincter dyssynergy, vesicoureteral reflux, DO with elevated detrusor pressures).<sup>5</sup> These individuals require close monitoring with annual clinic appointments, annual upper tract imaging and renal function studies, and repeat urodynamics based on changes in clinical symptoms.<sup>5</sup>

Patient factors are also important, including adherence. Clinic visit frequency should be at the discretion of the provider.

**History and physical. During visits, new urological symptoms or issues should be identified.** A discussion about ongoing medical issues is crucial as these may impact the health of the augment or the patient's capacity to manage their AC/CC. The provider should obtain prior medical and operative reports for new patients. A complete surgical history is key, although sometimes not feasible for remote operations. A focused assessment includes a focused history (catheterizations, urinary tract infections [UTIs], hematuria, urinary symptoms/incontinence, reproductive health, bowel symptoms) and a focused physical exam.

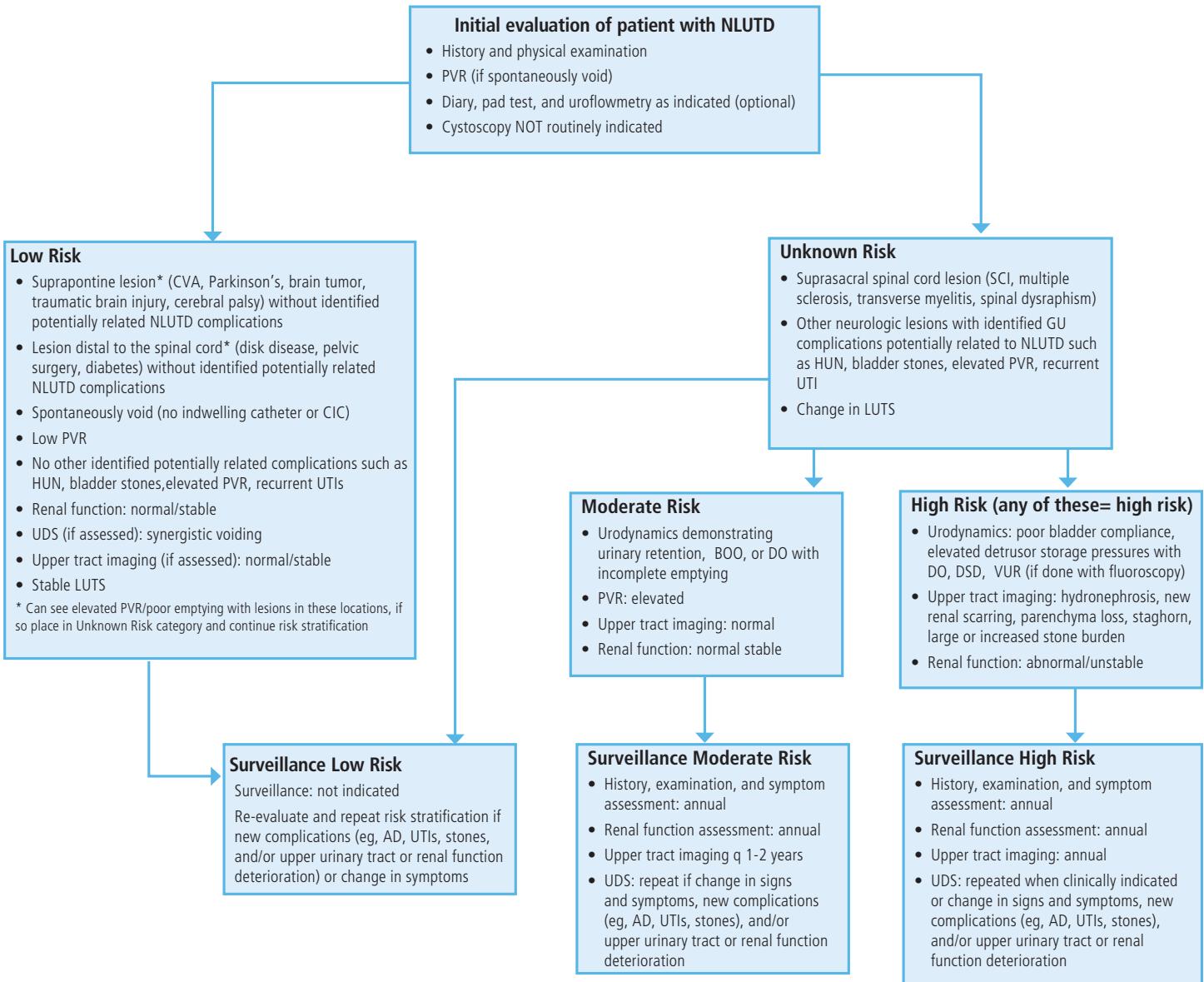
**Catheterizations:** Patients should be queried regarding their clean intermittent catheterization (CIC) regimen, including frequency, approximate volumes, catheter size, catheter type, any difficulties with catheter passage, and possible issues with mucous clogging. They should be asked regarding any need for change in size of the catheter, particularly downsizing. It is important to inquire about adequate supplies.

**UTI:** Asymptomatic bacteriuria (ASB) is common among AC patients, affecting over half of subjects.<sup>4,6</sup> However, rates of UTIs range from 4%-43%.<sup>4,6,7</sup> **Patient education regarding ASB and bacterial colonization is essential to minimize the risk of overtreatment.** Treatment of ASB occurs when urine is tested routinely without symptoms. Patients should be questioned regarding UTI symptoms, including fever, painful catheterization, urgency/frequency, malaise, dysuria, discomfort over bladder, incontinence, or flank pain. Patients should be asked about signs of a UTI, including gross hematuria, foul-smelling urine, cloudy urine, or increased mucus production.<sup>5</sup> Neurogenic patients may report autonomic dysreflexia or increased spasticity.<sup>5</sup> Providers should also inquire about the frequency of UTIs, positive cultures, technique for specimen collection, and antibiotic prescriptions, as well as symptoms suggestive of calculi. Patients should be asked about preventive measures for UTIs, including increased fluid intake, methenamine, supplements, or bladder irrigations.<sup>4,6,8</sup> For patients performing bladder irrigations, frequency, volume, and solution type should be determined. Again, it is important to ensure patients have adequate supplies.

**Hematuria:** Gross hematuria should be addressed at every appointment and patients should be counseled to

**ABBREVIATIONS:** augmentation cystoplasty (AC), asymptomatic bacteriuria (ASB), artificial urinary sphincter (AUS), basic metabolic panel (BMP), catheterizable channel (CC), clean intermittent catheterization (CIC), detrusor overactivity (DO), lower urinary tract dysfunction (LUTD), neurogenic lower urinary tract dysfunction (NLUTD), urinary tract infection (UTI)

## Neurogenic Lower Urinary Tract Dysfunction Risk Stratification Flow Chart



**Figure 1.** AUA Neurogenic Lower Urinary Tract Dysfunction (NLUTD) Guideline risk category algorithm.<sup>1</sup> AD indicates autonomic dysreflexia; BOO, bladder outlet obstruction; CVA, cerebrovascular accident; CIC, clean intermittent catheterization; DO, detrusor overactivity; DSD, detrusor sphincter dyssynergia; GU, genitourinary; HUN, hydronephrosis; LUTS, lower urinary tract symptoms; NLUTD, neurogenic lower urinary tract dysfunction; PVR, post-void residual; SCI, spinal cord injury; UDS, urodynamics; UTI, urinary tract infection; VUR, vesicoureteral reflux. Reprinted with permission from Ginsberg DA, et al. *J Urol.* 2021;206(5):1097-1105.<sup>1</sup>

**contact the clinic if this develops.** Providers should inquire about frequency, timing, duration, and other concurrent symptoms. It is important to assess for malignancy potential, as well as other pathologies associated with hematuria (ie, calculi, UTI, traumatic catheterization). It is vital to ask about smoking status, chemical exposures, and family history.

**Malignancy is estimated to occur in 1.2% of the population with AC/CCs,<sup>9</sup> although subjects with a history of congenital abnormalities, immunocompression/immunosuppression and gastrocystoplasty (which is not performed anymore) are at higher risk.<sup>4,6,10,11</sup> Some have proposed routine endoscopic surveillance after 10 years, while others recommend surveillance for concerning symptoms.<sup>4,6,9,12</sup> NLUTD guidelines suggest limited utility for routine cystoscopy.**

**Urinary Symptoms/Incontinence:** Urinary symptoms, especially incontinence, should be addressed. **New onset or worsening incontinence may imply progression of LUTD, which could pose a risk to renal function.** Incontinence may also indicate progressive sphincteric dysfunction, or noncompliance with CIC.<sup>5</sup> Providers should ask when leakage occurs (ie, in relation to CIC, with cough or sneeze, with associated urgency, total incontinence), where the leakage occurs (from channel vs urethra), and information regarding prior outlet procedures. Information about childbirth and hysterectomy in women, prostate procedures in men, prior pelvic procedures, radiation history, or urethral stricture disease is key. Fistulas should also be on the differential if patients report continuous incontinence.

**Reproductive Health:** Among women of child-bearing age with AC/CC, plans for future pregnancies may be discussed.<sup>13</sup> Pregnant women with AC/CC have an increased risk for UTI, preterm labor, and upper tract obstruction, and should be appropriately counseled.<sup>6,14</sup> Among women with compromised renal function and history of bladder exstrophy, one-third will develop preeclampsia.<sup>13</sup> Pregnant patients should be asked about flank pain, difficulties with catheterizations, UTI frequency, and new leakage symptoms.

**Generally, vaginal delivery is the preferred modality for delivery.<sup>14</sup> Among women with bladder exstrophy or complex bladder neck reconstruction, elective C-sections should be encouraged.<sup>13</sup>** Urologists should advise on risks of urological complications associated with C-sections (19% vs 3% in vaginal delivery).<sup>15,16</sup> Many women opt for elective C-sections to minimize the chance of emergent C-section.<sup>14</sup> **A urologist should assist in exposing the gravid uterus in C-sections after complex reconstructions.<sup>15,16</sup>**

**Bowel Symptoms:** Many patients with AC and a neurogenic bladder report concomitant neurogenic bowel. Bowel habits, constipation, and bowel regimens should be discussed. Additionally, patients with AC may suffer from malabsorptive disorders, with 25% reporting diarrhea.<sup>6,17</sup> Bowel dysfunction is an important risk factor for metabolic disturbance and calculi.<sup>17</sup> Roughly 3%-20% of patients report fecal incontinence depending on bowel segment used and length.<sup>17,18</sup> Approximately 10% of patients develop a small-bowel obstruction over the course of 20 years.<sup>17</sup> While classically an acute presentation, symptoms of nausea/vomiting, distention, new onset constipation, and lack of flatus might suggest this diagnosis. Patients with significant bowel symptoms may be referred to gastroenterology for management. Patients may have also undergone procedures such as the Malone antegrade continence enema or cecostomy. Assisting patients with these channels is important.

**Focused Physical Exam:** The catheterizable stoma should be assessed to ensure no granulomas, scar tissue, or parastomal hernias. If the patient reports new leakage, a female pelvic exam should be considered. Patients with pelvic organ prolapse should be examined especially if they catheterize via native urethra (which can cause kinking). If the patient reports flank pain, one might perform a costovertebral angle test.

**Labs and imaging.** Renal Surveillance<sup>5</sup>: AUA NLUTD guidelines recommend annual labs for moderate- and high-risk patients.<sup>1</sup> This generally includes a basic metabolic panel (BMP) for creatinine and electrolyte assessment. An annual (or biennial) renal ultrasound should be obtained as well. New patients with AC/CC should have baseline BMP and upper tract imaging. If there are abnormal labs or new clinical symptoms, imaging may be obtained. In patients with abnormal renal function but normal imaging, it is reasonable to refer to nephrology for further assessment.

**Metabolic Testing:** Metabolic derangement is a known sequela. Five percent of patients with ileal or colonic augmentation will develop hyperchloremic metabolic acidosis (bicarbonate <21 mEq/mL or chloride >100 mEq/dL) over 10 years; this number rises to 15% over 30 years.<sup>17</sup> Once bicarbonate is ≤21 mEq/mL, patients start oral sodium bicarbonate. **The goal is to minimize metabolic acidosis, which promotes bone demineralization, exacerbates renal disease, and**

**increases stone formation.<sup>17</sup>** A BMP should be obtained every 1-2 years to monitor for these abnormalities. In patients with compromised renal function, metabolic testing should occur at least annually.

Vitamin B12 deficiency is a known metabolic abnormality when distal ileum or ileal-cecal segments are used for augmentation. This generally manifests 3-5 years after surgery, with a rate of 8% by 15 years post-procedure.<sup>17</sup> Providers may assess baseline levels postoperatively, but routine testing (every 1-2 years) need not begin for 3-5 years after surgery.<sup>17</sup> If levels are low, oral supplementation is generally sufficient for most individuals.

**Additional studies. There is currently no role for routine surveillance cystoscopy or urodynamics.** As discussed above, these tests should be ordered based on new clinical symptoms or changes in renal function/imaging.

## NEW CLINICAL ISSUES/DIAGNOSES

The following diagnoses are among the most common issues that arise during long-term follow-up of patients with AC/CC. This section reviews each diagnosis and a management plan.

***Bladder calculi.* It is estimated that 10%-50% of patients with AC will develop bladder stones, with cystolitholapaxy being the most common urological surgery after AC.<sup>6,17,19-21</sup>** Patients with continent diversions who are catheter dependent are 5-10 times more likely to develop bladder stones than patients with orthotopic cystoplasty.<sup>19</sup> The biggest risk factor is believed to be urinary stasis<sup>19,21</sup>; other risk factors include increased mucus, bacteriuria, and metabolic abnormalities (primarily hypocitraturia).<sup>17,20</sup> Of note, gastrocystoplasty is associated with lower rates of calculi.<sup>20</sup>

**Suspect a stone if the patient reports new onset recurrent UTIs, gross hematuria, increased frequency/urgency, difficulty with catheter passage or drainage, or new incontinence.** Imaging should be ordered, which may include a renal ultrasound or CT scan depending on the presenting symptom(s). Prior reconstructive history guides treatment approach for confirmed stones. For individuals with orthotopic augments or a patent urethra/bladder neck, endoscopic attempts may be reasonable. For patients with CC and bladder neck closure procedures, a percutaneous approach may be employed. If the stone burden is excessive, some may opt for open removal.<sup>19</sup> Regardless of approach, it is critical to remove all stone burden as more than 50% are infectious in nature and will recur (58% with struvite, and urine cultures positive for proteus and klebsiella).<sup>17,20</sup>

**After adequate clearance of bladder stone burden, prevention is key.** A few studies have reported decreased rates of stone recurrence with saline irrigation regimens; effective regimens are either high volume (>240 mL) or at increased frequencies.<sup>7,17</sup> Counseling regarding best practices for catheterization, including positional issues which may result in urinary stasis, should be evaluated and addressed. Additionally, metabolic abnormalities should be corrected. If the patient has low urinary citrate secondary to metabolic acidosis, providers might consider prescribing potassium citrate.<sup>17</sup> A referral to nephrology for metabolic derangements is reasonable.

***Renal calculi.*** Renal calculi are estimated to occur in 15% of patients with AC, with 7% requiring surgical removal of stones.<sup>17,21</sup> Interestingly, subjects with bladder stones are 3 times

more likely to develop nephrolithiasis.<sup>22</sup> Among these renal stones, roughly 40% are struvite (infectious in nature) and 60% are secondary to metabolic abnormalities.<sup>17</sup>

With struvite stones, reflux should be evaluated. Patients with recurrent struvite nephrolithiasis are at an increased risk of renal failure due to risk of pyelonephritis and scarring.<sup>17,23,24</sup> Calculi secondary to metabolic disturbance may be due to metabolic acidosis (ie, calcium phosphate) or malabsorptive bowel disorders (ie, calcium oxalate).<sup>17,23</sup>

Patients may report acute flank pain, new onset urgency/frequency, fever, and/or gross hematuria with an obstructing ureteral stone. Patients may also report recurrent UTI if they have upper tract stone nidus. Obtain imaging to diagnose stone disease.

When treatment is warranted, providers may proceed with percutaneous, endoscopic, or shock wave lithotripsy based on stone features.<sup>22</sup> If opting for a retrograde approach, it is important to consider prior bladder neck procedures as well as possible ureteral reimplants. Often for patients who have undergone bladder neck procedures, a percutaneous approach provides optimal access.

After resolution of the stone burden, prevention is key with either bacteriuria prevention or correction of metabolic derangements and bowel issues. It is reasonable to refer the patient to nephrology for correction of metabolic disorders or gastroenterology for bowel management.

**Mucus clogging.** Mucus clogging of catheters is a common issue. Patients with cecocystoplasties produce significantly more mucus than ileocystoplasty, which predispose to infections, stones, and incomplete emptying.<sup>6</sup> Ensure that subjects are adherent with catheterizations and/or using a catheter with adequate lumen size. Due to both the time required for drainage and mucus extraction, we prefer catheters that are  $\geq 14\text{F}$  caliber (but a smaller caliber can be used if draining adequately). Some patients may benefit from a refresher on catheterization technique. If technique and size are appropriate, providers should consider getting a bladder ultrasound to assess for debris burden and calculi. If no stone is present, the patient should be started on regular bladder irrigations. Irrigations should be saline-based and be performed as needed (ranging from a few times per week to a few times daily). Small studies have also reported a role of oral ranitidine to decrease mucus production.<sup>25</sup>

**Recurrent UTI.** If the patient has a UTI (vs ASB), urinalysis and urine cultures should be obtained. Patients may begin empirical antibiotics based on prior culture data.

Catheterization regimens should be discussed to ensure adherence. If this is the first UTI episode, the patient should be counseled about increased fluid intake and catheter technique.<sup>8</sup> If the patient is having repeated infections ( $\geq 2$  UTIs in 6 months), consider imaging to rule out a stone nidus and performing cystoscopy. If no stones or anatomical etiologies are identified, providers may begin bladder irrigations with saline or gentamicin.<sup>5</sup> Intravesical irrigations are preferred over oral prophylactic antibiotics when feasible. Irrigations with volumes  $>240$  mL daily have been shown to be effective.<sup>7</sup> If breakthrough infections continue despite irrigations, prophylactic oral antibiotics may be considered.<sup>8</sup> Additionally, providers can educate about other preventive supplements, including methenamine, D-mannose, probiotics, and

cranberry extract; none have been definitively demonstrated to decrease colonization in this cohort, but there are minimal associated risks.<sup>5,8</sup>

**Lastly, recurrent UTIs may be a sign of new underlying bladder pathology and neurological changes.** If imaging and cystoscopy are negative, providers should consider repeating urodynamics.<sup>1</sup> In patients with AC, this should be performed with fluoroscopy to assess for reflux as well.<sup>1</sup>

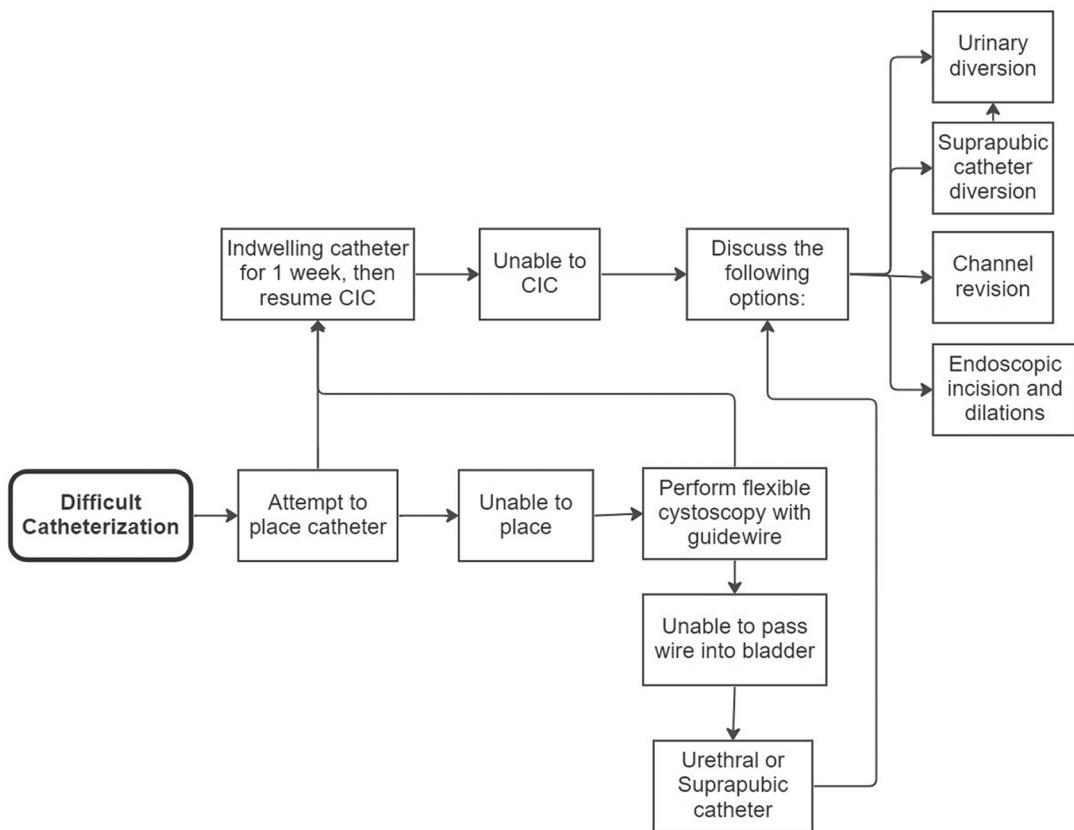
**Channel complications.** Nearly 40% of patients will report channel complications, which may include difficulty catheterizing, stomal stenosis, channel strictures, false passages, and stomal leakage.<sup>26</sup> Patients generally report difficulty catheterizing, but follow-up questions should determine the location of the defect and facilitate diagnosis.

The risk of stomal stenosis with CC is 8%-13%.<sup>17,26</sup> This rate is influenced by surgeon experience, type of channel, follow-up time, and patient's BMI.<sup>17</sup> Patients usually report progressive difficulty with initial insertion of the catheter and a downsize in catheter size. Exam of the stoma may reveal scar tissue and stenosis, although assessment may be difficult for umbilical channels. Depending on the extent of scarring, dilation and a trial of indwelling catheter dilation may be performed for 1-2 weeks. Overnight L-stents (a straight catheter with a knot/kink a few centimeters from the tip) have also been used to conservatively manage stenosis in a pediatric population.<sup>27</sup> Topical steroid ointment can be applied for treatment of the scar.<sup>28</sup> Ultimately, 50% of patients with stomal stenosis will require surgical revision.<sup>17</sup>

False passages occur acutely and may be secondary to channel strictures, which tend to occur more frequently in patients with elevated BMI (due to vascular compromise from channel stretch) and in the Yang-Monti.<sup>17</sup> Patients may report gradual difficulty in catheter passage through the channel secondary to a stricture. In these instances, providers may attempt to pass a silicone coudé catheter, but if any resistance is met, do not proceed. Office cystoscopy with a flexible ureteroscope may be performed to pass a wire beyond the stricture and false passage. If successful, a catheter can be left in place for 1 week to allow for dilation of stricture and healing of false passage.<sup>26</sup> If unable to perform CIC after catheter removal, next steps include endoscopic dilation/incision of the stricture vs channel revision, vs suprapubic catheter diversion vs conversion to urostomy/conduit (depending on the severity).<sup>17</sup> If unable to pass a sensor wire beyond the level of the stricture/false passage, a urethral catheter should be placed (if there are no prior bladder neck procedures) or a suprapubic catheter should be urgently placed (Figure 2).

Stomal leakage may be due to poor adherence with catheterizations, altered angulation of the channel, or new bladder pathology. Office cystoscopy can be performed to assess the channel and bladder for stones. **If this is negative, providers might consider urodynamics to rule out functional progression of LUTD (which is covered in the next section).** If the stoma is capacious, endoscopic bulking agent can be administered to the channel. However, the patient may ultimately require channel revision vs suprapubic catheter or conversion to an incontinent diversion.<sup>17,28</sup>

**Incontinence.** New-onset incontinence is a fundamental symptom that must be assessed. Timing of leakage should be determined (ie, with abdominal straining, close to the next



**Figure 2.** Management of false passages/strictures of catheterizable channel. CIC indicates clean intermittent catheterization.

catheterization, associated with urgency, nocturnal enuresis) as well as a detailed history of prior bladder neck procedures. Associated symptoms should also be obtained. In women who report stress incontinence, a pelvic exam should be performed. Based on the history, providers may opt for urodynamics and cystoscopy. If there is suspicion of bladder neck or sphincter dysfunction, videourodynamics may be preferred.

For altered bladder storage symptoms on urodynamics, providers may consider antimuscarinics or  $\beta_3$  adrenergic agonists, or intravesical botulinum toxin to the remaining native bladder.<sup>5</sup>

For female patients with new sphincter deficiency or an open bladder neck, one might consider urethral bulking vs an occlusive autologous fascial sling. Bulking would likely need to be readministered and cure rates are poor,<sup>5</sup> while an autologous sling is irreversible. Fascia lata can be harvested for autologous slings if there is significant rectus scarring from prior surgeries. Men may be candidates for AUS, bulbar sling, or, in extreme cases, urethral ligation.

**Importantly, functional studies may uncover new LUTD. Risk category should be reassessed, and surveillance algorithms may change. Again, optimizing quality of life and protecting the upper tracts are 2 primary goals.<sup>1</sup>**

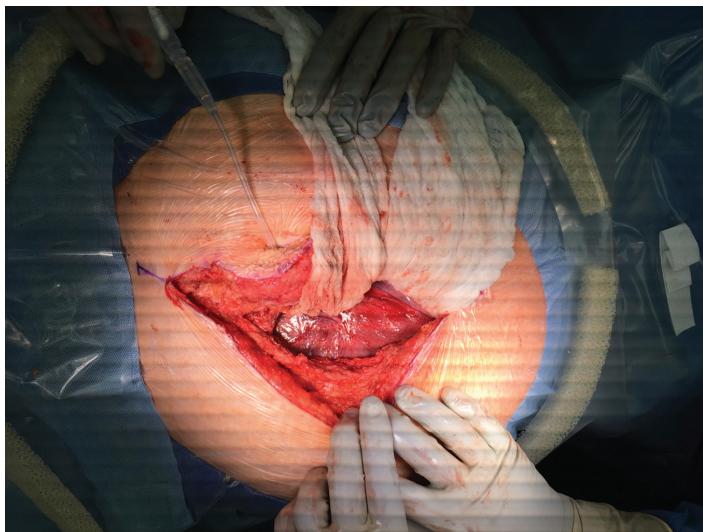
**Gross hematuria/malignancy.** Unless in the setting of UTI or bladder stones, gross hematuria warrants a workup with CT urogram, and cystoscopy to assess for malignancy.<sup>1,29</sup> Among all patients with AC, rates of malignancy are 1.2%. Factors such as smoking, immunosuppression/immunocompromise, exstrophy, and gastrocystoplasty will increase the risk of malignancy (4.5%).<sup>11,12</sup> Chronic exposure to nitrosamine, a carcinogen, with reservoir stasis is also believed to play a role.<sup>6,12</sup> Malignancy typically presents 10 years after AC at the enterovesical anastomosis and is

**commonly adenocarcinoma.**<sup>9,30</sup> If malignancy is identified, tumor biopsy/resection should be performed for staging and then AUA Bladder Cancer Guidelines should be followed.<sup>31,32</sup>

**Pregnancy.** With normal baseline renal function, pregnancy does not compromise renal function or reconstruction.<sup>14</sup> Pregnancy among women with AC/CC is associated with increased rates of UTI, pyelonephritis (16%-18%), upper tract obstruction, difficulty with CIC (5%-50% require indwelling Foley), and pre-term labor (35% deliver before 37 weeks).<sup>6,13-15</sup> Post-delivery, 88% report continence at 3 years; 10% of women undergo a procedure for stress urinary incontinence, which mirrors the general population.<sup>15</sup>

**Unless contraindicated (ie, exstrophy history and reconstructed anterior pubis, contracted hips), elective vaginal delivery should be planned.**<sup>13</sup> Bey et al reported urological complications during C-section (elective and emergency), including injury to ileocystoplasty n=11, ureteral injury n=1, vesicocutaneous fistula n=2, transection of AUS/infection requiring explant n=2, and false passage to CC with Foley at start of case n=1.<sup>15</sup> Interestingly, C-section modality was chosen by most of these women to prevent urological sequelae.

**Risks and benefits should be discussed with the patient, and the urologist should communicate directly with the obstetrics team.** The urologist should get access to the gravid uterus after complex reconstruction via a high midline or paramedian incision (Figure 3).<sup>13</sup> To start, catheters should be placed in the channel and urethra (if possible). Next, the vascular pedicle, which is usually found on the patient's right side near the root of the mesentery (usually from the ileocecal artery), may be identified.<sup>13</sup> Adequate exposure of the uterus for delivery is often accomplished without exposure of the vascular supply or bladder.



**Figure 3.** Exposure of gravid uterus. Credit: Melissa Kaufman, MD, PhD.

In the event of pedicle injury, providers should observe initially as collateralization usually preserves the augment. Postoperatively, catheters should be left in place and the patient can be managed expectantly.

## URGENT/EMERGENT SYMPTOMS

It is critical for the following emergent situations to be on the differential as they can be life-threatening. The following section describes the initial presentation and management plans.

**Urinary retention.** Patients in urinary retention require prompt bladder drainage. Once the bladder is too full, it can be challenging to drain via CC due to kinking. If there is a patent outlet and intact urethra, a urethral catheter can be passed. If the bladder neck has been closed or the urethra cannot be accessed, you can attempt once to pass a coudé catheter into the CC. The next step is to perform bedside cystoscopy/ureteroscopy via channel to pass a guidewire and catheter, or to decompress the bladder via percutaneous aspiration with portable ultrasound or CT guidance. Aspiration can be performed with an 18F spinal needle. If the patient cannot tolerate bedside procedures with analgesia/local anesthetic, they should be taken to the operating room immediately.

Once the bladder has been partially emptied, a catheter can generally be passed via channel. Depending on the duration of

retention, providers must consider post-obstructive diuresis.<sup>3</sup> An indwelling catheter can be left in the CC to monitor outputs.<sup>3</sup> A BMP should be obtained to assess for electrolyte disturbance or uremia. Patients with appropriate mental status can be offered oral replacement if they are appropriately diuresing.

If the intense abdominal pain at presentation does not resolve with drainage or urine outputs are low after catheter placement, providers should consider a perforation. If patient is stable, CT cystogram should be obtained.

**Perforation.** Bladder perforation is a known risk of AC, occurring in 3%-13% of subjects.<sup>24,33-35</sup> Risk factors include outlet procedures, use of sigmoid colon, nonadherence with catheterization, and substance abuse.<sup>24,35</sup> This is an emergency condition that may require a high level of suspicion to diagnose. Update Series, Volume 39, Lesson 23 contains a detailed summary about perforation management.<sup>36</sup>

## CONCLUSION

Long-term surveillance and management of subjects with AC/CC can be performed safely outside of tertiary centers. Providers should anticipate issues and complications during clinic encounters. Providers also need to adequately evaluate patients based on risk factors and clinical history to preserve quality of life and renal function.

### DID YOU KNOW?

- Surveillance and management of patients with AC and CCs aim to preserve renal function and optimize quality of life.
- While the NLUTD guidelines exist, management is highly individualized and should be at the discretion of the provider.
- It is critical that providers who care for these patients have a strong understanding of their medical and surgical history.
- Rates of complications are high in this population, especially for UTI, stones, and channel issues.
- Do not overlook new urinary complaints/symptoms as they might indicate progression of bladder disease.

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# Study Questions Volume 42 Lesson 20

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1. A 72-year-old male with an obliterative posterior urethral stricture and an augment with a catheterizable channel presents to the emergency room for difficult catheterization. He last catheterized 12 hours prior. He has significant abdominal discomfort and suprapubic distention. There is no abdominal guarding with palpation. Vitals are stable. What is your next step?
  - a. Place a urethral catheter
  - b. Order a CT scan and basic metabolic panel
  - c. Go to the operating room to emergently decompress his bladder
  - d. Percutaneously aspirate urine from his bladder
2. A 35-year-old female with a history of spina bifida who underwent bladder augmentation with Mitrofanoff creation as a teenager presents emergently for urinary retention. A urethral catheter was placed to decompress the bladder, draining only 200 mL of dark-colored, malodorous urine. Her blood pressure is normal, but her heart rate is 125. She reports significant persistent abdominal pain and exhibits significant guarding with palpation. Her white blood cell count is 18, and creatinine is 2.3. What is the next step?
  - a. Irrigate the catheter to ensure adequate position
  - b. Place second catheter per Mitrofanoff channel to maximize drainage
  - c. Take patient to the operating room for exploratory laparotomy
  - d. Order CT cystogram
3. A 65-year-old female with a history of refractory interstitial cystitis who underwent augment cystoplasty with catheterizable channel 5 years earlier reports 3 *Escherichia coli* urinary tract infections in the past 5 months. She endorses adequate fluid intake and performs intermittent catheterizations every 4 hours with volumes of 300-450 mL. She undergoes imaging and cystoscopy, of which both are negative. How to proceed in management of this patient?
  - a. Increase catheterization frequency
  - b. Encourage increased fluid
  - c. Begin a bladder irrigation regimen
  - d. Start low-dose oral prophylactic antibiotic
4. A 28-year-old male with spina bifida who underwent ileocystoplasty with catheterizable channel approximately 10 years earlier presents for recurrent nephrolithiasis and pyelonephritis with increasing incontinence. He has had 4 episodes of pyelonephritis with associated kidney stones in the past 2 years. He endorses regular catheterizations and adequate fluid intake. Stone analysis has previously shown struvite. Recent renal ultrasound suggested scarring in the right kidney, and glomerular filtration rate is 50. What is your next step?
  - a. 24-Hour urine metabolic testing
  - b. Urodynamics with fluoroscopy
  - c. Begin gentamicin bladder irrigations
  - d. Order a basic metabolic panel
5. A 34-year-old female with a history of bladder exstrophy and bladder augment is 32 weeks pregnant. She has had an unremarkable pregnancy so far. She comes to your office for general recommendations. Which of the following do you advise?
  - a. Spontaneous vaginal delivery
  - b. Scheduled C-section
  - c. Routine renal ultrasound
  - d. Prophylactic antibiotics

## ERRATUM

### *Difficult Foleys and Foley Difficulties*

Volume 42, Lesson 4, Page 36: “Over the filiform, a follower is used to dilate the urethra.” has been changed to “A follower is then screwed onto the end of the filiform and used to dilate the urethra.” The online and PDF versions of Lesson 4 have been updated to reflect this change.