

Urgency and urgency incontinence following stress urinary incontinence surgery: A review of evaluation and management

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ABSTRACT

The presence of urgency urinary incontinence (U/UI) after sling surgery is a common reason for dissatisfaction and imposition on quality of life. We aimed to evaluate and analyze the pathophysiology, evaluation, and treatment of U/UI after sling surgery. A MEDLINE review was performed for relevant, English-language articles relating to storage and emptying symptoms after sling surgery. U/UI may persist, be improved, or worsen in women with preoperative mixed urinary incontinence and may appear *de novo* in those women originally presenting with pure stress urinary incontinence (SUI). While the exact mechanism is not clear, partial bladder outlet obstruction (BOO) should always be suspected, especially in those women with worsened or *de novo* symptoms soon after sling surgery. Initial workup should elucidate the temporality, quality, and bother associated with symptoms and to evaluate the woman for urinary tract infection (UTI), pelvic organ prolapse (POP), or perforation of the lower urinary tract. The utility of urodynamics in attaining a definitive diagnosis of BOO is inconclusive. Treatment options include reevaluation of the patient after sling incision or after addressing UTI, POP, and perforation of the bladder or urethra. Women also typically undergo a multitiered approach to storage lower urinary tract symptoms outlined in the American Urological Association/Society of Urodynamics, Female Pelvic Medicine and Urogenital Reconstruction Overactive Bladder Guidelines. While improvement is typically seen with multimodality treatment, all women should be counseled regarding need for additional treatment for U/UI, BOO, and SUI in the future.

INTRODUCTION

Before a discussion of storage lower urinary tract symptoms (LUTS) after surgery for stress urinary incontinence (SUI), it is important to define the common symptoms and terms [Table 1].^[1] It is paramount to discreetly define the unique symptoms that bother an incontinent woman as her treatment options vary considerably. Women with urgency and urgency urinary incontinence (U/UI) will typically be offered options summarized in the American Urological Association (AUA)/Society of Urodynamics, Female Pelvic Medicine and Urogenital Reconstruction (SUFU) Guidelines on the Diagnosis and Treatment of Adult,

Nonneurogenic Overactive Bladder (OAB),^[2-4] as well as the recently published European Association of Urology Guidelines on the Diagnosis and Management of Female Non-neurogenic LUTS.^[5] Women with SUI also have multiple options for treatment, with slings placed at the bladder neck (BNS) or midurethra (MUS) being the most common surgical interventions.^[6] The MUS is the most extensively researched surgery for female SUI, and its effectiveness in resolving SUI has been well documented by Cochrane systematic reviews.^[6]

While MUS typically have a favorable safety profile, the presence of postoperative U/UI has been cited as a

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significant source of dissatisfaction after any sling surgery.^[7,8] The mere presence of postoperative U/UII should raise additional questions. Did the woman have preoperative

U/UII or did her symptoms appear *de novo*? If she had preoperative symptoms, are her postoperative symptoms similar, better, or worse? What is the chronicity of her symptoms and the temporal relationship between the symptoms and sling surgery? Does she have additional signs or findings, such as urinary tract infection (UTI), hematuria, or elevated postvoid residual (PVR)? What is clear is that multiple factors must be considered when determining the optimal workup and treatment for this population. Owing to postoperative U/UII serving as a significant source of morbidity and dissatisfaction after sling surgery, our goals are to elucidate its epidemiology, pathophysiology, evaluation, and treatment. We have framed the discussion of the literature on several questions.

Table 1: Definitions of common symptoms used in this review (adapted from The International Urogynecological Association/International Continence Society Joint Terminology for Female Pelvic Floor Dysfunction^[11])

Symptom	Abbreviation	Definition
Stress urinary incontinence	SUI	Complaint of involuntary loss of urine on effort or physical exertion (e.g., sporting activities), or on sneezing or coughing
Urgency urinary incontinence	UII	Complaint of involuntary loss of urine associated with urgency
Mixed urinary incontinence	MUI	Complaint of involuntary loss of urine associated with urgency and also with effort or physical exertion or on sneezing or coughing
Increased daytime urinary frequency	F	Complaint that micturition occurs more frequently during waking hours than previously deemed normal by the woman
Urgency	U	Complaint of a sudden, compelling desire to pass urine which is difficult to defer
Overactive bladder syndrome	OAB	Urgency, usually accompanied by frequency and nocturia, with or without UII, in the absence of UTI or other obvious pathology
Detrusor overactivity*	DO	The occurrence of involuntary detrusor contractions during filling cystometry. U/UII may or may not occur. If a relevant neurological cause is absent, idiopathic DO is noted

*DO is a finding on urodynamics and is not a symptom. It is included for its definition. UTI=Urinary tract infection, U/UII=Urgency and urgency urinary incontinence, DO=Detrusor overactivity

WHAT IS THE INCIDENCE OF PERSISTENT, WORSENERD, AND *DE NOVO* URGENCY AND URGENCY URINARY INCONTINENCE AFTER SLING SURGERY?

Like evaluating other outcomes after MUS surgery, assessing the incidence or prevalence of postoperative U/UII in the literature is challenging. For one, studies may report urinary urgency, UII, OAB, DO, or some combination of symptoms and findings. In addition, the symptoms may be qualified and quantified by multiple objective, subjective, validated, and non-validated instruments. For example, in a review of 20 studies encompassing 1950 patients, Stanford and Paraiso quoted an overall DO incidence of 15.4% (range, 1.7% to 42.4%).^[9] From the study, it is unclear whether the search term “DO” applied to solely a urodynamic finding or, more likely, was used as an all-encompassing term for U/UII

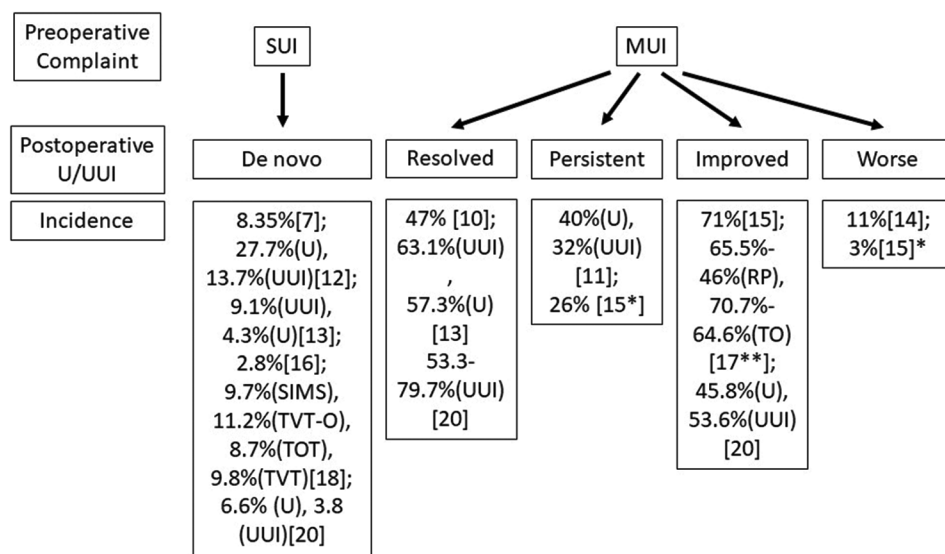


Figure 1: Representative incidence of postoperative U/UII after midurethral sling surgery from the literature. Key: U, urgency; SUI, stress urinary incontinence; MUI, mixed urinary incontinence; UII, urgency urinary incontinence; SIMS, single-incision mini-sling; TVT, transvaginal tape; TVT-O, TVT obturator; TOT, transobturator tape; RP, retropubic; TO, transobturator. Notes: *Study includes autologous rectus fascia slings and midurethral slings. **Range indicates waning improvement from 12-month to 60-month follow-up

as well as urodynamic DO. In addition, it is unclear whether the cited incidence is of *de novo* symptoms only or includes persistent symptoms and/or those that worsened after surgery. Furthermore, the review included multiple types of MUS and BNS, some of which were constructed of “historic” materials which are no longer used in sling surgery. Not unexpectedly, the incidence of U/UII reported in the literature ranges widely, which underscores the need for explicit definitions for the reporting of UI in the literature [Figure 1].

The type of anti-incontinence surgery impacts the incidence of postoperative LUTS. In the Cochrane review, the average postoperative voiding dysfunction rate for retropubic and transobturator MUS groups was 5.53%, but the rates were significantly lower in the transobturator group.^[7] Similarly, the incidence of LUTS after BNS is consistently higher than that after MUS. Mahdy and Ghoniem reported an incidence for *de novo* urgency and UII after autologous BNS of 15%–20% and 7.2%, respectively,^[21] while Yang *et al.* similarly cited a 21.1% incidence of U/UII after this procedure.^[22] In their analysis of several RCTs, the Urinary Incontinence Treatment Network reported that, at 5-year follow-up, the proportion of women reporting worsening of storage symptoms ranged from 19.8% to 30.2% (autologous BNS), 11.7% to 21.4% (transobturator MUS), and 11.0% to 21.3% (retropubic MUS).^[17] As mentioned previously, the authors of this analysis found that they were limited in their ability to compare their findings to other studies because of differences in outcome measures, definitions of OAB symptoms, and endpoints.

WHAT FACTORS ARE ASSOCIATED WITH POSTOPERATIVE U/UII?

In their review of risk factors for postoperative storage symptoms, Marcelissen and Van Kerrebroeck identified multiple risk factors for the literature.^[23] These included obesity, parity, history of cesarean section, concurrent prolapse surgery, nocturia, and several urodynamic indices (elevated detrusor pressure, lower maximum bladder capacity, higher detrusor pressures at DO, absence of SUI on urodynamics, and opening detrusor pressure). The most common risk factors, not unexpectedly, were preoperative OAB symptoms, attendant anticholinergic use, previous incontinence surgery, DO on urodynamics, and older age.^[23]

Several perioperative factors may also contribute to U/UII after surgery. UTI (with or without concomitant urinary retention) and bladder or urethral penetration should always be part of the differential diagnosis. Furthermore, the temporal relationship between symptoms and surgery should be closely considered. In the acute postoperative setting, pelvic floor muscle tension from the sling or concomitant pelvic organ prolapse (POP) surgery, impact of anesthesia,

colorectal dysfunction, and postoperative pain (with or without the effects of narcotic pharmacotherapy) can all contribute to postoperative LUTS. Indeed, in the first 6 weeks after MUS, over 60% of all women may experience some undesired LUTS which negatively influence their quality of life.^[24] Fortunately, immediate postoperative symptoms frequently undergo natural resolution within a few months of surgery and delay in active intervention should be considered.^[25,26]

Long-standing, partial bladder outlet obstruction (BOO) could certainly contribute to a delayed onset of storage LUTS as may be seen in males with prostatic enlargement. However, the eventual possibility of developing bladder decompensation or refractory U/UII in the setting of partial BOO has not been well documented in the female population after anti-incontinence surgery. Finally, it has been shown that the rate of UII improvement seen in the short term after MUS surgery wanes with longer follow-up.^[17] While this may be attributed to age-related changes in storage/emptying variables and pelvic floor support, the ultimate reason is not clear.

WHAT IS THE PATHOPHYSIOLOGY OF POSTOPERATIVE U/UII?

The relationship between defects in pelvic floor support (SUI and POP) and other storage LUTS (U/UII, OAB) is complex, incompletely understood, and beyond the scope of this review. However, several possible theories and potential justifications deserve mention. Perhaps the simplest concept is considering U/UII and SUI as two separate conditions, each independent of the other. In this scenario, addressing the stress component should have no impact on the urge component, which would remain unchanged after anti-incontinence surgery. Hence, any change in U/UII during the postoperative follow-up would be considered idiopathic and attributed to nonsurgical factors. Unfortunately, it does not appear that this relationship is that simple, since it has been shown that U/UII may worsen, improve, resolve, or appear *de novo* after surgery. Furthermore, the prevalence of MUI is significantly and disproportionally higher than expected, suggesting that MUI is composed of several subtypes and one or more begin to predominate as a woman ages.^[27]

On the other hand, several mechanisms propose a connection between pelvic support and U/UII, with most focusing on the bladder neck and proximal urethra as the key. Serels *et al.* proposed that an increase in intra-abdominal pressure stretches the pelvic nerves and causes a reflex bladder contraction,^[28] while others proposed that a reflex bladder contraction results from urine entering the proximal urethra due to an incompetent sphincter/bladder outlet or urethral funneling.^[29,30] McLennan *et al.* suggested that shorter functional urethral length allows urine to enter

the proximal urethra and cause reflex DO,^[31] while Jung *et al.* cited activation of urethral afferent signaling with subsequent DO.^[32] Swash proposed that hypermobility of the proximal urethra during stress maneuvers causes peripheral denervation of the pelvic floor musculature which, in turn, leads to DO.^[33] This mechanism may also partially explain the connection between storage symptoms and POP. Finally, Minassian *et al.* suggested that MUI is a heterogeneous condition and that stress-induced UII comprises the most common variant, especially as the woman ages.^[19] It follows, then, that surgical resolution of SUI may lead to improvement or resolution of U/UII. Conversely, increased pressure on the bladder neck may result in DO or U/UII which may account for the higher incidence of these findings after BNS compared to MUS.^[7]

The relationship between POP and storage LUTS is also complex and there are several theories linking the two. Brading suggested that DO is promoted by relative BOO (as may be seen in cases of increasing anterior compartment POP) via increased smooth muscle excitability and electrical coupling, which may be reversed by POP reduction.^[34] It is intuitive that BOO and elevated PVRs may contribute to U/UII, with subsequent improvement after the POP is addressed.^[35-37] In addition, in their Integral Theory, Petros and Ulmsten proposed that ligamentous laxity may be associated with disorders of the pelvic floor.^[38] Subsequently, Liedl *et al.* demonstrated that repair of this laxity has been associated with a durable improvement in OAB symptoms.^[39] At present, the Integral Theory remains the primary justification responsible for improvement or resolution of U/UII after MUS.

WHAT IS THE EVALUATION OF A PATIENT WITH POSTOPERATIVE U/UII?

A detailed history and physical examination are the hallmarks of any investigation of postoperative U/UII [Table 2]. It is important to remember that the patient's recall may be poor and additional steps (e.g., requesting previous records and contacting prior surgeons) may be necessary. A midstream urine specimen should be analyzed for hematuria and evidence of UTI, while a catheterized urine specimen should be obtained in cases of contamination or urinary retention. A suspicious microscopic urine examination should prompt obtaining a urine culture and, if positive, culture-specific antibiotics should be initiated. A PVR should be obtained in all patients and a noninvasive uroflow may be helpful in some cases. Worsened or *de novo* U/UII in the setting of objective and subjective evidence of impaired emptying suggests partial BOO. The degree of bother should be ascertained, as, in some circumstances, a woman whose severe SUI was improved or resolved after MUS may opt to manage her U/UII non-surgically, so as not to risk recurrent SUI after sling incision. Formal urethral dilation should be avoided in these patients. To rule out urethral/bladder perforation with a foreign body, cystoscopy

Table 2: Focused history and physical examination in women with postoperative urgency and urgency urinary incontinence

History	
Was there U/UII before surgery?	
If yes, is the current U/UII better, same, or worse compared to before surgery?	
If yes, was a medication used for symptoms before surgery?	
When did the symptoms start in relation to surgery?	
Was an objective measure of preoperative urinary symptoms used (i.e., validated questionnaire)?	
Were preoperative urodynamics performed and, if so, are those available for review?	
What type of surgical procedure was performed for SUI?	
Were any adjunct procedures performed for POP or other reconstructive reasons?	
Were there any voiding LUTS before surgery and at present?	
Is an operative report from the current surgery available?	
If yes, this should be reviewed for surgical details and any deviations from standard technique	
Has there been any gross hematuria or dysuria?	
Were any previous pelvic surgeries performed?	
Was there a requirement for a prolonged indwelling catheter or was there immediate voiding?	
How bothered is the patient by her symptoms?	
Physical examination	
Skin incisions (lower abdominal, suprapubic, transobturator, none)	
Urethral mobility and results of cough/Valsalva stress test	
Characterization of POP	
Degree of postoperative vaginal healing	
Degree of vaginal estrogenization	
Points of tenderness	

Foreign bodies (e.g., stiches or mesh), exposed or subepithelial.

POP= Pelvic organ prolapse, U/UII= Urgency and urgency urinary incontinence, SUI= Stress urinary incontinence, LUTS= Lower urinary tract symptoms

should be performed in any woman with accompanying gross or microscopic hematuria and should strongly be considered in any woman with bothersome U/UII after surgery (acute or delayed onset).

WHAT IS THE ROLE OF URODYNAMICS IN THE EVALUATION OF POSTOPERATIVE U/UII?

Urodynamic evaluation is controversial in these patients. As most anti-incontinence procedures are being performed without preoperative urodynamics, there is often no opportunity to compare preoperative and postoperative findings. Urodynamics can certainly be helpful in diagnosing BOO; however, a characteristic high-pressure, low-flow pattern is not typically seen. Since women can normally void without a strong detrusor contraction, or via pelvic relaxation, postoperative pressure-flow data may not ultimately influence the decision to loosen or incise the sling. Other urodynamic findings, such as DO or decreased bladder capacity, provide information but, likewise, may not impact the decision-making process. Indeed, only the pathognomonic high-pressure, low-flow pattern on urodynamics in a patient with worsened or *de novo* U/UII should lead to a definitive procedure to alleviate BOO. Otherwise, the decision will typically be made based on the

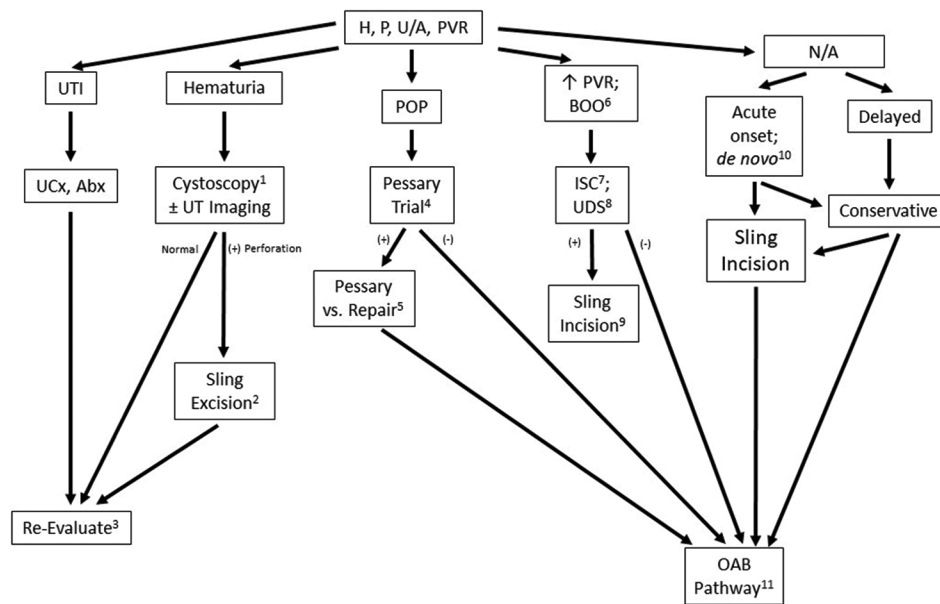


Figure 2: Evaluation and treatment algorithm for women with postoperative U/UI. U, urgency; UUI, urgency urinary incontinence; H, history; P, physical examination; U/A, urinalysis; PVR, postvoid residual; UTI, urinary tract infection; Abx, antibiotics, UT, upper tract; POP, pelvic organ prolapse; BOO, BOO, intermittent self-catheterization; UDS, urodynamics; N/A, none; OAB, overactive bladder. Notes: (1) Cystoscopy may be considered at any point in the workup, regardless of temporal relationship to original surgery or type of symptoms. (2) May be performed through a transvaginal or transabdominal approach (with laparoscopic or robotic assistance). (3) If symptoms improve or resolve, no additional treatment may be necessary. If bothersome symptoms persist, workup with history, physical, urinalysis, and PVR should be repeated. In the setting of LUTS and anterior compartment POP, a brief pessary trial can be attempted. If the symptoms improve with pessary in place, either a long-term pessary or POP repair may be considered. 5. While either option may still be performed for bothersome and symptomatic POP, the patient should be counseled that their U/UI may persist and additional treatment via the OAB pathway may be beneficial. (6) A high suspicion for BOO should be maintained through the clinical presentation, even in the absence of elevated PVR or frank urinary retention. (7) While ISC is the preferred method of managing LUTS in the setting of elevated PVR, an indwelling urethral or suprapubic catheter may also be considered. (8) A high-pressure, low flow pattern on UDS makes the diagnosis of BOO definitive. As women do not require a sustained bladder contraction to void efficiently under normal circumstances, the absence of a high-pressure, low-flow pattern does not rule out BOO. Fluoroscopy (video-UDS) may be helpful to delineate the location of obstruction during the pressure-flow study. (9) A midline sling incision through a transvaginal approach is accepted as the initial procedure of choice in a woman with a previous MUS. Some surgeons will remove several mm of sling on either side of midline at the time of surgery to maximize voiding afterward. As there is no definitive method of determining how much sling to remove, this step must be balanced with the increased possibility of redeveloping SUI afterward. Those women who underwent an autologous BNS may require a more extensive sling excision or urethrolysis. All women should be counseled regarding the potential for additional surgical procedures in the future for SUI, BOO, or both. (10) If there is a strong temporal relationship between worsened or *de novo* bothersome UUI and MUS, consideration may be given for MUS incision in the early postoperative period (>4 weeks). Typically, a period of conservative management (with or without OAB pharmacotherapy) is reasonable before proceeding with another surgical procedure. (11) References^[2-5]

available clinical data and surgeon experience. Simultaneous fluoroscopy during urodynamics can localize the area of BOO to the bladder neck or midurethra. EMG may assist in diagnosing a woman with voiding dysfunction; however, true detrusor external sphincter dyssynergia would not be found in a neurologically intact female.

WHAT ARE THE TREATMENT OPTIONS FOR POSTOPERATIVE U/UI?

One of the main limitations in evaluating the literature regarding the management of postoperative U/UI is the lack of Level 1 evidence. With no current guidelines to guide the practitioner, the following recommendations are based on retrospective cohort studies and the authors’ collective experience [Figure 2].

ACUTE PRESENTATION

If U/UI is worse immediately after surgery, the sling operation itself is the likely culprit. This scenario should

first prompt an investigation for UTI or bladder/urethral perforation. If present, these should be addressed first and reevaluation for U/UI performed after adequate healing has taken place.

If not associated with BOO: If the PVR is low, there is no evidence of urethral hypersuspension on examination, and the patient is not complaining of voiding symptoms, U/UI may be initially addressed conservatively. It has already been mentioned that approximately 60% of women will have undesirable LUTS in the acute postoperative setting,^[37] and postoperative edema, pelvic pain and need for narcotic medication, defecatory dysfunction, and pelvic floor muscle spasm may account for temporary storage and emptying LUTS. As these may improve spontaneously, intervention for OAB has been recommended by some at 1 month postoperatively in patients with preexisting urgency and after 6 months in those without preoperative urgency.^[20,39] Empiric treatment in the acute setting may include behavioral modification, NSAIDs, antispasmodics, and stool softeners. If elected, OAB-specific treatment

includes multitiered therapy as described in the AUA/SUFU OAB Guidelines and EAU Guidelines.^[2-5]

While there is certainly a possibility of concomitant partial BOO in this scenario, this is often challenging to prove. Furthermore, loosening or incising a sling that (a) has resolved SUI, (b) has not caused postoperative voiding LUTS, and (c) may not improve U/UII, is a daunting proposition. If sling incision in this scenario is being considered, the patient should be counseled extensively regarding all the attendant complications associated with repeat vaginal surgery. If U/UII is associated with significant anterior vaginal wall POP (in the absence of BOO), a pessary trial may provide additional information.

If associated with BOO, if the PVR is elevated, or if there is complete urinary retention, the patient should be started on intermittent self-catheterization (ISC) to assist with emptying. If the voiding symptoms do not improve, a sling incision may be considered at a period between 2 and 4 weeks. The patient should be counseled regarding the risks of sling incision, such as recurrent SUI, urethral injury, persistent BOO, and persistent U/UII. Urodynamic evaluation in this scenario may not change the eventual management but remains an option. If the patient underwent an autologous fascial BNS, a longer period (up to three months) may be given, as these procedures may loosen spontaneously over time. If the patient's BOO improves over the first 6 weeks of follow-up, a conservative approach may be undertaken. This would include behavioral modification, antispasmodics, and consideration for OAB pharmacotherapy.

If associated with significant anterior compartment POP, coexistent POP can lead to kinking of the urethra at the level of the bladder neck and may result in BOO and U/UII. In this instance, a pessary trial may be beneficial. If the BOO and U/UII resolve with the pessary in place, these symptoms are associated with the POP and addressing POP with a pessary or surgically may help alleviate the LUTS. If the symptoms persist despite adequate anterior compartment support and subsequent urethral unkinking, surgery or pessary may not completely resolve the LUTS, and the patient should be counseled appropriately.

DELAYED OR CHRONIC PRESENTATION

If U/UII present in a delayed fashion after sling (especially years later), the cause is more likely to be idiopathic. It should be mentioned that BOO and bladder/urethral perforation should always be considered and an evaluation for these may still be clinically indicated. The longer the delay in presentation, the more challenging the scenario. All the suggestions for acute presentation apply, with a few caveats. In a woman with an elevated PVR and suspected concomitant BOO, urodynamics may be helpful to document if the woman mounts any detrusor

contraction to void. As mentioned previously, the absence of a bladder contraction does not rule in BOO, since women can void efficiently without a detrusor contraction. The only definitive finding would be a high-pressure, low-flow pattern. An initial program of ISC would be beneficial in patients with an elevated PVR. If the U/UII improves with resolution of impaired emptying, additional effort may be given to improving the patient's emptying in the long-term. Sling incision can be considered; however, the restoration of efficient voiding and improvement of U/UII have not been well documented in a delayed presentation model. In a cohort of 107 women who underwent sling revision for LUTS, Crescenze *et al.* noted that those women presenting with UII were significantly more likely to experience a >6-month delay to revision, compared to those presenting with voiding LUTS.^[40] The authors also noted that, after sling revision, UII persisted in 76.5% of 68 women and developed *de novo* in 43.6% of 39 women. Extensive counseling should be performed in this scenario, and additional modalities for SUI, BOO, and U/UII are typically needed in the long-term. In a woman with U/UII and no evidence, or minimal evidence, of BOO, the OAB pathway provides the tools for treatment.^[2-5] These women should be evaluated with cystoscopy to rule out bladder/urethral mesh perforation, along with other anatomic abnormalities.

WHAT ARE THE OUTCOMES OF TREATMENT WITH 2ND-AND 3RD-TIER OAB THERAPY FOR POSTOPERATIVE U/UII?

Although randomized trials are absent, there is ample evidence for 2nd- and 3rd-tier OAB therapy in women with U/UII after anti-incontinence surgery. Studies have demonstrated the positive impact of antimuscarinics,^[41,42] sacral neuromodulation,^[43,44] and onabotulinumtoxinA in this scenario.^[45] There is also limited evidence that pretreatment with pharmacotherapy may benefit the patient in the immediate postoperative period. Rechberger *et al.* reported on 328 women who underwent transobturator MUS and were randomly assigned to prophylaxis with 10 mg of solifenacin, prophylaxis with 50 mg of mirabegron, or no additional treatment.^[46] The authors noted that the prevalence of urgency and frequency episodes increased notably 1 week after sling placement and then returned to baseline. Solifenacin and mirabegron significantly reduced the incidence of urgency after 1 week, but the beneficial effect at 6 weeks was observed only with solifenacin. Treatment with mirabegron reduced the percentage of patients suffering from frequency after 6 weeks. Both treatments significantly reduced the incidence of nocturia at 6 weeks.

GAPS IN KNOWLEDGE

There are several gaps in our understanding of postoperative U/UII. First, the lack of a unified or single mechanism

of action limits our grasp of the connection between preoperative symptoms, the surgery itself, and postoperative symptoms. Additionally, the development of idiopathic, age-related storage symptoms may further cloud our understanding. Second, as mentioned previously, the lack of Level 1 data makes drawing conclusions about the optimal treatments, and their timing, challenging. RCTs (between sling incision and medical therapy, for example) would certainly help fill in the gaps in our knowledge; however, we are not aware of any such ongoing trials. Having a strong suspicion for BOO and respecting the temporal relationship between surgery and symptoms come with experience and represent the art of surgery.

CONCLUSIONS

The presence of U/UII after sling surgery is a common reason for dissatisfaction and imposition on quality of life. The symptoms may be improved, persistent, or worsened in women with preoperative MUI and may appear *de novo* in those with pure SUI. While the exact mechanism is not clear, partial BOO should always be suspected, especially in those women with worsened or *de novo* symptoms soon after sling surgery. Initial workup should elucidate the temporality, quality, and both of symptoms, and to evaluate the woman for UTI, POP, or perforation of the lower urinary tract. The utility of urodynamics in cementing the diagnosis of BOO is questionable. Treatment options include reevaluation after sling incision or addressing UTI, POP, and perforation of the bladder or urethra and the multitiered approach to storage LUTS outlined in the AUA/SUFU OAB Guidelines and EAU Guidelines.^[2-5] While improvement is typically seen, all women should be counseled regarding need for additional treatment for U/UII, BOO, and SUI in the future.

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