

Surgical Management of Recurrent Stress Urinary Incontinence Following Anti-Incontinence Procedures

Learning Objective: At the conclusion of this continuing medical education activity, the participant will be able to identify risk factors for recurrent stress urinary incontinence following anti-incontinence procedures; recognize key findings during an examination, history, and testing of women with recurrent stress urinary incontinence that would assist in deciding the best next step; and describe ways to better counsel and discuss conservative and surgical options for patients with recurrent stress urinary incontinence following anti-incontinence procedures.

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 Female Pelvic Medicine.



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KEY WORDS: recurrent stress urinary incontinence, midurethral sling, pubovaginal sling, bulking agent, intrinsic sphincter deficiency

INTRODUCTION

Stress urinary incontinence (SUI) is the “complaint of involuntary loss of urine on effort or physical exertion (eg, sporting activities), or on sneezing or coughing” (ie, with increases in abdominal pressure).¹ Estimates on the prevalence of SUI in women vary widely. The Boston Area Community Health Survey reported weekly urinary incontinence in 10.4% of women aged 30 to 79 years; of those women, 26.4% had stress-type incontinence and 56.7% reported mixed incontinence.² **An updated systematic review and meta-analysis of surgical treatment of female SUI, including open retropubic colposuspension, autologous fascial slings, and midurethral sling (MUS), showed that up to 4 in 10 women suffer from persistent incontinence after surgery or develop a recurrent problem at some point after their primary operation.**^{3,4} When evaluating long-term outcomes, the 9-year cumulative incidence of repeat surgery after 1 or more SUI surgeries in women aged 18 to 64 years was 14.5%.² The type of repeat surgery performed was sling (70.5%), followed by bulking agents (20.1%) and Burch colposuspension (6.5%).⁵ **The best surgical treatment for a woman who has failed a prior sling is unknown.**^{6,7} We aim to provide incontinence surgeons with an overview of the nuances of evaluation and management of recurrent SUI after a failed surgical procedure. Given that almost all repeat surgical procedures involve a sling or bulking agent, this Update will focus on these modalities along with newer approaches and conservative measures.

Bulking agents have a low cure rate^{8,9} when performed as an initial procedure for SUI. If SUI is incompletely treated with a bulking agent, this would not be a failure of the technique, but a limitation of the procedure. Hence, this Update will not discuss the management of failure of a primary bulking agent, and these women do not need the workup described here, but rather should engage in shared decision-making and move to a surgical option if that is their desire.

Also, in the modern era few surgeons perform Burch colposuspension, and the care of a woman who has failed this procedure for primary SUI treatment should be managed in a similar fashion to an MUS failure since these procedures are both performed for hypermobility.⁵

EVALUATION OF WOMEN WITH RECURRENT SUI AFTER ANTI-INCONTINENCE PROCEDURES

The evaluation of a patient with recurrent SUI after surgery should include a medical history and physical exam to demonstrate SUI and to assess for prior surgical complications. Medical history should include urinary symptoms or any testing prior to the initial surgery, the exact type of previous SUI surgery, including the operative report,

the timing of failure, the characterization of the incontinence (stress, urgency, mixed), the frequency, and the severity.¹⁰ Overactive bladder (OAB) symptoms with urge urinary incontinence (UI) are very common in the general population and increase in incidence with age¹¹ with 47% of women over 65 years of age reporting OAB. **Many women also do not understand the subtle difference between UII and SUI and feel that their sling has failed even with pure UII.** Hence distinguishing between UII and SUI is paramount since slings only treat the latter. It is also clear that a woman who never achieved relief from her SUI postsurgery is different from a woman who achieved dryness for a period of years and whose stress incontinence has returned gradually. The physical exam should focus on any complications from her prior procedure including mesh exposure or pain over a sling, high-tone pelvic floor, urethral hypersuspension or persistent hypermobility, prolapse that may need to be treated, and in very rare instances fistulas or other complications leading to incontinence.

AUA Guidelines recommend additional evaluation in women with persistent or recurrent SUI after previous definitive surgical intervention.¹² The consensus is that cystoscopy and urodynamic testing should be considered in patients with prior anti-incontinence surgery. These tests are invaluable since a patient who has a significant complication, such as a mesh erosion into the bladder or urethra or a mesh exposure in the vagina, would need treatment of these complications factored into the decision-making. Also, the discovery of bladder outlet obstruction (BOO) from their prior procedure would need to be corrected with sling division before stress incontinence can be adequately addressed.

Urodynamic studies with or without fluoroscopy are useful in evaluating for intrinsic sphincter deficiency (ISD), which is common in patients who fail slings, as well as for detrusor overactivity (DO) or BOO. **The urodynamic measure of abdominal leak point pressure is the most used to define ISD.** Abdominal leak point pressure is defined by the International Continence Society as the intravesical pressure at which urine leakage occurs due to increased abdominal pressure in the absence of a detrusor contraction. The most often cited cutoff is <60 cm H₂O,¹³ but the International Continence Society definition is more subjective and is defined as a “very weakened urethral closure mechanism.”¹⁴

Possible reasons for recurrence include the incorrect procedure performed, such as a woman who had predominantly UII having a stress incontinence procedure. It could also be that an inappropriate technique was used, such as a mini sling in a woman with significant ISD, or due to technical surgical skills or a complication. To discern plausible causes and aid in further treatment options, additional testing along with history and physical exam are crucial. Other risk factors for incontinence that occur with age should be considered as the cause. Weight gain over time can result in the return of SUI or the development of a condition predisposing to cough. Functional incontinence from loss of mobility or cognitive decline should

ABBREVIATIONS: autologous fascial pubovaginal sling (AFPVS), artificial urinary sphincter (AUS), bladder outlet obstruction (BOO), detrusor overactivity (DO), intrinsic sphincter deficiency (ISD), midurethral sling (MUS), overactive bladder (OAB), pubovaginal sling (PVS), stress urinary incontinence (SUI), urge urinary incontinence (UII)

also be sought. Treatment of medical conditions with diuretics can also lead to a recurrence of incontinence after a sling.

COUNSELING OF WOMEN AFTER FAILED ANTI-INCONTINENCE PROCEDURES

After a thorough evaluation identifies primarily SUI and further treatment is indicated due to bothersome symptoms, it is important to adequately counsel the patient regarding treatment options. It is important to reflect the patient's wish for further treatment, clear postoperative expectations, and knowledge of surgical risks, including complications with the added explanation of the increased chance of failure given a prior failed procedure already. **The lack of high-quality data guiding surgical management decisions should also be discussed to emphasize that this is a controversial decision with different perspectives among providers.** This process should involve shared decision-making, where the treatment and care plan is based on clinical evidence that balances risks and expected outcomes with patient preference and values. These women have already failed a surgical procedure and may be hesitant to have another surgery, and may prefer more noninvasive treatments. When counseling about treatment options, the discussion must consist of conservative management including pelvic floor physical therapy, weight loss, timed voiding, vaginal inserts, incontinence pads, or incontinence pessary, as well as surgical procedures.

MUS

The MUS is the most performed procedure for female SUI, with an extensive safety and efficacy profile for the retropubic transobturator and MUS.¹⁵ The cure rates for synthetic MUS range from 62% to 97% subjectively and 70.2% to 92% objectively. **Risk factors for failure of MUS include BMI >35, mixed incontinence, previous continence surgery, ISD, and diabetes mellitus.**¹⁶ For those patients who have residual or recurrent SUI a repeat MUS can be offered with slightly lower efficacy when compared to the first sling surgery. When evaluating the incontinence outcome, women undergoing repeat MUS procedures had almost 2 times the odds of SUI treatment failure, but greater improvement in symptoms and quality of life, compared to those undergoing a primary MUS procedure.¹⁷ A literature review for the effectiveness of MUS in recurrent SUI showed good cure rates after MUS surgery following previous incontinence surgery (62%-100%).¹⁸

The decision of removing or transecting the previous sling vs leaving the sling when undergoing a second MUS has limited data. A retrospective cohort study on the continence rate of women who underwent excision of the primary MUS and placement of a second sling was compared to a cohort who underwent a repeat MUS, which showed a continence rate of 48% in "second primary" vs 56% in the repeat group.¹⁹

Repeat mesh MUS has traditionally favored the placement of a retropubic configuration of the repeat sling since this better treats ISD, which is one of the major reasons for original sling failure. In those women with immediate sling failure who were first treated with a transobturator or mini sling this would seem a reasonable approach. The repeat sling is not placed under any extra tension and is performed in the same manner as a primary sling, hence in women who have failed an initial

retropubic sling performed correctly, some would argue that doing the identical surgery again when it has already failed is questionable. In a woman with immediate sling failure and urodynamic ISD following the procedure, a repeat mesh sling is unlikely to resolve the incontinence, and this would be a situation where a pubovaginal sling (PVS) would be favored. In women who have initial success with an MUS and gradually lose efficacy, the decision is more straightforward since urethral sphincter aging is the likely source of recurrent SUI since maximum urethral closure pressure is known to decrease with age.²⁰

PVS

After a mesh complication or sling failure, many women and surgeons prefer to avoid a repeat mesh procedure and choose an autologous fascial pubovaginal sling (AFPVS). These fascial slings are typically harvested from the abdominal rectus fascia or fascia lata and do not use foreign material. The sling is placed at the level of the proximal urethral/bladder neck and tunneled up to be tied above the rectus fascia.

After a failed synthetic MUS, a retrospective review of 66 women showed autologous PVS is effective and cured SUI in 69.7% of cases, and requiring a mesh excision for complications did not predict a worse outcome when compared to cases in which mesh was not removed.²¹ A multi-institutional prospective cohort of 288 women who all underwent AFPVS had an excellent objective cure of SUI, with 20.4% of the cohort undergoing AFPVS as salvage after MUS, who had a 55.9% cure rate of SUI, compared to the remainder who underwent de novo AFPVS and achieved a 62.4% cure rate.²² A multi-institutional retrospective review of women undergoing AFPVS (n = 71) and tension-free vaginal tape (n = 153) after an MUS failure showed similar cure rates of 61.4% and 66.1% and no significant difference in postoperative questionnaire outcomes.²³

The advantage of the autologous tissue technique is the avoidance of more mesh material and its ability to treat severe incontinence. Also, the prospect of repeating an MUS in a patient who has just failed this procedure can be disheartening to patients. Given the absence of a prospective study comparing MUS to AFPVS following MUS failure, patients must be counseled about the lack of data on best approaches.

PERIURETHRAL INJECTIONS

Urethral bulking agents are a minimally invasive surgical procedure used for the treatment of SUI. These injections can be performed in the office or operating room. Using a cystoscope, periurethral injection of a permanent bulking material leads to the support of the urethral sphincter, resulting in better coaptation. Bulking agents primarily treat ISD, and a prior sling that already treated hypermobility is a complementary combination to correct SUI. Different types of agents can be used including silicon microparticles (Macroplastique), pyrolytic carbon-coated zirconium oxide bead (Durasphere), calcium hydroxyapatite (Coaptite), and polyacrylamide hydrogel (Bulkamid).²⁴

Of the agents available, polyacrylamide gel has studies focusing on recurrent SUI after MUS. In patients with persistent or recurrent SUI following urethral sling procedure, 71%

experienced short-term improvement or resolution of symptoms following urethral bulking agent injections, with SUI-specific improvement persisting at an average of 35 months in patients with available data.²⁵ A registry study performed to assess the utility of periurethral bulking with polyacrylamide hydrogel in women with SUI after MUS included 57 women, of whom 72.9% had a negative stress test postoperatively and 73.7% were satisfied with treatment.²⁶

The cure rates and satisfaction after bulking agents for patients with persistent SUI after MUS, particularly in the presence of ISD, are favorable. A meta-analysis of 8 studies that included 767 patients who received treatment with polyacrylamide hydrogel found that 24.3% required reinjection, and the most common side effects were pain at the injection site (4%-14%) and urinary tract infection (3%-7%).²⁷ Both the number of incontinence episodes and volume were reduced at 1-year follow-up, and quality of life was improved.²⁷ In our clinical experience a bulking agent will not cure severe persistent incontinence, but those women who achieve significant improvement after a sling and desire a “tweak” or enhancement of their sling perform well. Also, women who have a slow deterioration of the sling efficacy (likely age-related loss of maximum urethral closure pressure) benefit from a “top-up” of their sling.

ARTIFICIAL URINARY SPHINCTER

Artificial urinary sphincter (AUS) is usually reserved for women with refractory SUI after more than 1 continence surgery or severe urinary incontinence. A recent review of the current use of AUS in adult women showed promising perioperative outcomes over the past few years with laparoscopic and, more recently, robotic techniques of AUS implantation in female patients. The indications for AUS are typically recurrent or persistent SUI after previous anti-incontinence procedures and neurogenic SUI.²⁸ A long-term outcome study showed in female patients that the risk of erosion is high although overall continence is satisfactory.²⁹ **This technique is not considered a standard of care in women and remains investigational.**

OTHER APPROACHES TO SLING FAILURE

Different approaches to less invasive treatments are being studied. A case series recently reported the outcomes of sling plications performed on women who presented with persistent SUI after MUS. The plication consists of placing absorbable sutures in the sling to provide further support. Sling plication showed the success rate for the plication of retropubic slings was 76.9% and significantly higher compared with 40% for transobturator slings; long-term data are needed to assess adequate success rate.³⁰

PRINCIPLES OF SLING TREATMENT FAILURE

When evaluating a patient with failure of her SUI surgery, it is important to investigate the possible reasons for the incontinence recurrence. There are 3 distinct presentations of sling failure: immediate failure, complications, and late failure (Figure).

Immediate failure. Women may present at their first postoperative visit or within the first year of surgery with continued incontinence. In some women, the surgical procedure for incontinence was not the correct choice. **A woman with initial unrecognized urgency-predominant incontinence will not get significant improvement after a sling procedure.** A careful history of her incontinence preoperatively and a review of any preoperative testing can often help identify between evidence of mixed urinary incontinence or de novo OAB from the sling placement. Provided she is emptying her bladder after a few months of therapy with an oral agent for OAB (since some women develop mild OAB after a sling), investigations should be undertaken. Urodynamics would typically demonstrate the absence of SUI and possibly DO, but DO is not always present in UI. These women, if not obstructed, should be treated according to the AUA/SUFU (Society of Urodynamics, Female Pelvic Medicine & Urogenital Reconstruction) OAB Guideline.^{31,32}

Another possibility is that the woman suffered from severe ISD and had a procedure that was inadequate to treat this problem, especially the obturator or mini-MUS that is designed to treat hypermobility. These women will possibly report improved SUI after their sling but would have predominantly SUI symptoms. **In women with ISD, the physical exam would reveal a well-supported urethra and SUI.** There is also the possibility that her sling was not tensioned properly. A careful review of operative reports can sometimes reveal incorrect procedures such as sling under tensioning or incorrect location of placement. After cystoscopic confirmation of no mesh complications and urodynamics, if there is any suspicion of UI or obstruction, shared decision-making should involve discussion of options of repeat retropubic mesh sling given the positive data on the success of this approach vs an autologous PVS that is designed to treat both hypermobility and ISD.

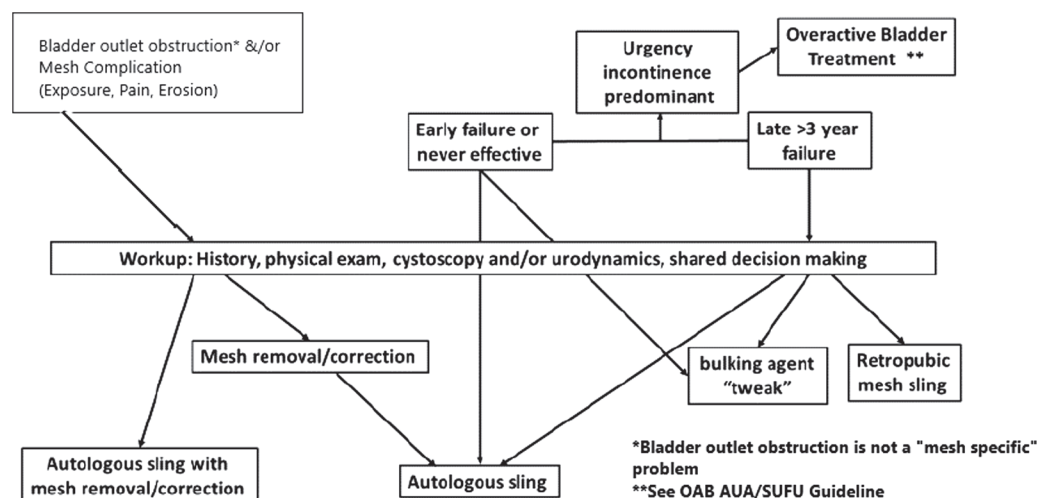


Figure. Diagnosis and treatment algorithm for surgical management of recurrent stress urinary incontinence following anti-incontinence procedures. AUA indicates American Urological Association; OAB, overactive bladder; SUFU, Society of Urodynamics, Female Pelvic Medicine & Urogenital Reconstruction.

Complications. There are several surgical complications that can lead to continued incontinence after a sling procedure. An overtensioned sling can result in BOO that either leads to overflow incontinence or can result in UII symptoms. Physical exam may reveal excess tension and hypersuspension of the urethra. Even if residual urine is negligible, urodynamics should still be performed since BOO is difficult to diagnose in women with only a uroflow. The solution to this issue is sling division and reassessment of symptoms. **There is no evidence to suggest what surgical approach is favored to treat residual SUI after a sling division, but the authors favor treating this patient like a primary SUI patient given that her sling is no longer supporting her urethra.** Inherent to mesh MUS is the possibility of mesh-related complications that require treatment. Mesh exposure in the vagina or mesh erosion into the urethra or bladder can be diagnosed with a physical exam and/or cystoscopy and require excision of the surgical mesh. Although these complications are not an absolute contraindication to repeat mesh sling procedures, most women will not consent to more mesh placement, especially after having this type of complication, and should be offered autologous tissue or bulking agents.

Late failure. A careful history of risk factors for incontinence such as weight gain, functional or cognitive decline, new diabetes with glucosuria, urinary tract infections, OAB, or medications that can predispose to incontinence are all possible culprits and should be treated accordingly. **Urethral function is known to decrease over time as women age.**²⁰ Women with urethral aging as the cause of their leaking would present with a slow recurrence of their SUI. These women would have had initial surgical success with many years of continence with a gradual onset of SUI. A complete workup is still indicated before undertaking any surgical procedures since complications, even BOO, can present late and confirming SUI on urodynamics is paramount given the high incidence of OAB in women with aging. These women should be counseled the same as a woman with primary SUI¹² on: conservative options; bulking agents for less severe incontinence; and that a repeat surgical procedure with any modality would be appropriate given that the same disease process has simply progressed over time.

CONCLUSION

Even with high cure rates after MUS, recurrence or residual SUI can occur. It is important to accurately diagnose SUI and any possible complications with physical exam, history, cystoscopy, and urodynamics before undertaking any invasive procedures. One needs to determine the degree of

symptoms and extent of bother to adequately manage the patient. When a conservative approach does not provide the desired outcome, surgical management is safe and provides good symptom relief although not as successful as primary procedures. In those patients with mesh-related complications such as pain, erosion, or exposure, removal of the offending mesh along with any needed reconstruction can be performed simultaneously with a repeat sling or these procedures staggered. Given that these complications were the result of the mesh, almost all women chose nonmesh sling alternatives such as AFPVS. In those women with improved incontinence or a gradual decline in sling efficacy, a bulking agent is a great tweak of the symptoms, and polyacrylamide hydrogel injections have data to support their efficacy in this situation. When considering a second anti-incontinence sling procedure, the decision between a repeat MUS and AFPVS is based on the patient's physical exam, symptom severity, urodynamics, and the patient's expectations. The surgical approach should be individualized with considerations regarding perioperative risks and patient's choice. Patients with severe incontinence or immediate failure may benefit from the increased urethral support and ISD management of an AFPVS since it is designed to treat both, but data are lacking from well-performed studies on the ideal management of these difficult cases.

DID YOU KNOW?

- Recurrent SUI after surgical treatment is a common condition; up to 15% of women will require further surgical treatment.
- Factors that affect risk of failure include advance age, obesity, diabetes mellitus, UII, intrinsic urethra deficiency, and pelvic organ prolapse.
- When evaluating recurrent SUI, it is important to assess the severity and bother of symptoms, and consider testing with cystoscopy and/or urodynamics.
- When deciding on treatment options, it is essential patients are aware of the risks and benefits of the treatment plan, and the process should use shared decision-making.
- Treatment options range from conservative lower-risk options such as bulking agents to surgical treatment including repeat/redo sling or AFPVS.

REFERENCES

1. Haylen BT, de Ridder D, Freeman RM, et al. An International Urogynecological Association (IUGA)/International Continence Society (ICS) joint report on the terminology for female pelvic floor dysfunction. *Neurourol Urodyn*. 2010;29(1):4-20.
2. Tennstedt SL, Link CL, Steers WD, McKinlay JB. Prevalence of and risk factors for urine leakage in a racially and ethnically diverse population of adults: the Boston Area Community Health (BACH) survey. *Am J Epidemiol*. 2008;167(4):390-399.
3. Tincello DG, Armstrong N, Hilton P, Buckley B, Mayne C. Surgery for recurrent stress urinary incontinence: the views of surgeons and women. *Int Urogynecol J*. 2018;29(1):45-54.
4. Novara G, Artibani W, Barber MD, et al. Updated systematic review and meta-analysis of the comparative data on colposuspensions, pubovaginal slings, and midurethral tapes in the surgical treatment of female stress urinary incontinence. *Eur Urol*. 2010;58(2):218-238.
5. Jonsson Funk M, Siddiqui NY, Kawasaki A, Wu JM. Long-term outcomes after stress urinary incontinence surgery. *Obstet Gynecol*. 2012;120(1):83-90.

6. Bakali E, Johnson E, Buckley BS, Tincello DG. Treatment of recurrent stress urinary incontinence after failed minimally invasive synthetic suburethral tape surgery in women. *Cochrane Database Syst Rev*. 2013;2:CD009407.
7. Bakali E, Johnson E, Buckley BS, Hilton P, Walker B, Tincello DG. Interventions for treating recurrent stress urinary incontinence after failed minimally invasive synthetic midurethral tape surgery in women. *Cochrane Database Syst Rev*. 2019;9:CD009407.
8. Casteleijn FM, Enklaar RA, El Bouyahyaoui I, Jeffery S, Zwolsman SE, Roovers J-PWR. How cure rates drive patients' preference for urethral bulking agent or mid-urethral sling surgery as therapy for stress urinary incontinence. *Neurourol Urodyn*. 2019;38(5):1384-1391.
9. Giammò A, Ammirati E, Geretto P, et al. Can urethral re-bulking improve the outcomes of a prior urethral bulking?. *Ther Adv Urol*. 2022;14:175628722110692.
10. MacLachlan LS, Rovner ES. Management of failed stress urinary incontinence surgery. *Curr Urol Rep*. 2014;15(8):429.
11. Sexton CC, Coyne KS, Thompson C, Bavendam T, Chen C-I, Markland A. Prevalence and effect on health-related quality of life of overactive bladder in older Americans: results from the epidemiology of lower urinary tract symptoms study. *J Am Geriatr Soc*. 2011;59(8):1465-1470.
12. Kobashi KC, Albo ME, Dmochowski RR, et al. Surgical treatment of female stress urinary incontinence: AUA/SUFU guideline. *J Urol*. 2017;198(4):875-883.
13. Parrillo LM, Ramchandani P, Smith AL. Can intrinsic sphincter deficiency be diagnosed by urodynamics?. *Urol Clin North Am*. 2014;41(3):375-381.
14. D'Ancona C, Haylen B, Oelke M, et al. The International Continence Society (ICS) report on the terminology for adult male lower urinary tract and pelvic floor symptoms and dysfunction. *Neurourol Urodyn*. 2019;38(2):433-477.
15. Dmochowski RR, Blaivas JM, Gormley EA, et al. Update of AUA guideline on the surgical management of female stress urinary incontinence. *J Urol*. 2010;183(5):1906-1914.
16. Stav K, Dwyer PL, Rosamilia A, Schierlitz L, Lim YN, Lee J. Risk factors of treatment failure of midurethral sling procedures for women with urinary stress incontinence. *Int Urogynecol J*. 2010;21(2):149-155.
17. Parden AM, Gleason JL, Jauk V, Garner R, Ballard A, Richter HE. Incontinence outcomes in women undergoing primary and repeat midurethral sling procedures. *Obstet Gynecol*. 2013;121(2):273-278.
18. Pradhan A, Jain P, Latthe PM. Effectiveness of midurethral slings in recurrent stress urinary incontinence: a systematic review and meta-analysis. *Int Urogynecol J*. 2012;23(7):831-841.
19. Melnikoff AK, Meyer I, Martin KD, Richter HE. Incontinence outcomes after "second primary" compared to repeat midurethral sling for recurrent and persistent stress urinary incontinence. *Int Urogynecol J*. 2021;32(1):75-80.
20. Chai TC, Huang L, Kenton K, et al. Association of baseline urodynamic measures of urethral function with clinical, demographic, and other urodynamic variables in women prior to undergoing midurethral sling surgery. *Neurourol Urodyn*. 2012;31(4):496-501.
21. Milose JC, Sharp KM, He C, Stoffel J, Clemens JQ, Cameron AP. Success of autologous pubovaginal sling after failed synthetic mid urethral sling. *J Urol*. 2015;193(3):916-920.
22. Parker WP, Gomelsky A, Padmanabhan P. Autologous fascia pubovaginal slings after prior synthetic anti-incontinence procedures for recurrent incontinence: a multi-institutional prospective comparative analysis to de novo autologous slings assessing objective and subjective cure. *Neurourol Urodyn*. 2016;35(5):604-608.
23. Aberger M, Gomelsky A, Padmanabhan P. Comparison of retropubic synthetic mid-urethral slings to fascia pubovaginal slings following failed sling surgery. *Neurourol Urodyn*. 2016;35(7):851-854.
24. Cameron AP, Haraway AM. The treatment of female stress urinary incontinence: an evidenced-based review. *Open Access J Urol*. 2011;3:109-120.
25. Dray EV, Hall M, Covalschi D, Cameron AP. Can urethral bulking agents salvage failed slings?. *Urology*. 2019;124:78-82.
26. Myhr SS, Rakovan M, Schiotz HA. Periurethral injection with polyacrylamide after previous TVT surgery. *Int Urogynecol J*. 2022;33(4):1017-1022.
27. Kasi AD, Pergialiotis V, Perrea DN, Khunda A, Doumouchtsis SK. Polyacrylamide hydrogel (Bulkamid®) for stress urinary incontinence in women: a systematic review of the literature. *Int Urogynecol J*. 2016;27(3):367-375.
28. Peyronnet B, Greenwell T, Gray G, et al. Current use of the artificial urinary sphincter in adult females. *Curr Urol Rep*. 2020;21(12):53.
29. Venn SN, Greenwell TJ, Mundy AR. The long-term outcome of artificial urinary sphincters. *J Urol*. 2000;164(3 Part 1):702-707.
30. Maheshwari D, Jones K, Solomon E, Harmanli O. Sling plication for failed midurethral sling procedures: a case series. *Female Pelvic Med Reconstr Surg*. 2019;25(1):e4-e6.
31. Gormley EA, Lightner DJ, Burgio KL, et al. Diagnosis and treatment of overactive bladder (non-neurogenic) in adults: AUA/SUFU guideline. *J Urol*. 2012;188(6 Suppl):2455-2463.
32. Lightner DJ, Gomelsky A, Souter L, Vasavada SP. Diagnosis and treatment of overactive bladder (non-neurogenic) in adults: AUA/SUFU guideline amendment 2019. *J Urol*. 2019;202(3):558-563.

Study Questions Volume 42 Lesson 40

1. A 45-year-old G2P2 with type 2 diabetes and a BMI of 24 underwent a noncomplicated midurethral sling (MUS) for stress urinary incontinence (SUI). Her biggest risk factor for MUS failure is
 - a. Age
 - b. Diabetes
 - c. Parity
 - d. BMI
2. In a woman with recurrent SUI after a midurethral sling, what urodynamics finding would make you recommend an autologous pubovaginal sling over other treatments?
 - a. Detrusor overactivity
 - b. Small bladder capacity
 - c. Valsalva leak point pressure <40 cm H_2O
 - d. Detrusor pressure at maximal flow <15 cm H_2O
3. A 57-year-old female 3 months following MUS reports urgency urinary incontinence without other complaints. Urinalysis is normal and postvoid residual 20 mL. What is the next best step?
 - a. Vaginal estrogen
 - b. Mirabegron
 - c. Urodynamics
 - d. Repeat MUS
4. An 80-year-old female with prior myocardial infarction and severe chronic obstructive pulmonary disease had a mesh MUS 7 years ago for severe SUI (6 pads daily). She presents with confirmed recurrent SUI requiring 1 pad daily, and desires treatment. The most appropriate treatment option is
 - a. Pubovaginal sling
 - b. Artificial urinary sphincter
 - c. Midurethral sling
 - d. Bulking agent
5. A 45-year-old runner had a successful transobturator tape (TOT) 5 years ago for SUI. She has noted a gradual recurrence of SUI symptoms to her baseline, particularly while running. Urodynamics reveals an abdominal leak point pressure of 82 cm H_2O without detrusor overactivity or obstruction. What is the next best step?
 - a. Repeat TOT
 - b. Mini sling
 - c. Tension-free vaginal tape
 - d. Bulking agent