



# Management of post-midurethral sling voiding dysfunction. International Urogynecological Association research and development committee opinion

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**Abstract** Voiding dysfunction following midurethral sling procedures is not a rare event. There is no current consensus regarding management of this complication. Although it is often transient and self-limiting, chronic post-midurethral sling voiding dysfunction may lead to irreversible changes affecting detrusor function. Initial management includes intermittent catheterization, and addressing circumstantial factors interfering with normal voiding, such as pain. Early sling mobilization often resolves the dysfunction, and is associated with minimal morbidity. Sling incision or excision at a later stage, although fairly effective, could be associated with recurrence of stress urinary incontinence. There is insufficient evidence to justify urethral dilatation in this context.

**Keywords** Stress urinary incontinence · Midurethral sling · Urinary retention · Voiding dysfunction · Urethral dilatation · Sling mobilization

## Abbreviations

CIC	Clean intermittent catheterization
MUS	Midurethral sling
OAB	Overactive bladder
PVR	Postvoid residual urine volume
SUI	Stress urinary incontinence
UDS	Urodynamic studies
UUI	Urgency urinary incontinence
VD	Voiding dysfunction

## Introduction

Polypropylene midurethral sling (MUS) is the most commonly performed surgical treatment for stress urinary incontinence (SUI) worldwide. Extensive research has confirmed its efficacy and acceptable risk profile in the short and medium term [1]. Among the recognized complications of MUS, postoperative voiding dysfunction (VD) can represent a disappointment for patients and a clinical dilemma for clinicians, especially because of the lack of an evidence-based or standardized management approach, and the possible need for reoperation [2]. Post-MUS VD may present as complete urinary retention or persistent voiding difficulty, urinary stream abnormalities, posture modification during micturition, with or without elevated postvoid residual urine volume (PVR) [3]. Overactive bladder (OAB) symptoms, such as frequency, urgency, and urgency urinary incontinence (UUI) may also be present. Although the exact incidence of VD after anti-incontinence surgery is not known, it has been estimated to occur in up to 20% of cases [2], and 1–10% may continue to be catheter-dependent >28 days postoperatively [4]. In a population-based cohort of 188,454 women who underwent MUS in the USA between 2001 and 2010, the rate of MUS revision or removal for VD was 1.3% [5].

This committee opinion is aimed at describing the evaluation and treatment of complications of post-MUS VD. It is

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based on a review of the English-language literature: nonsystematic reviews, cohort prospective and retrospective studies, case reports, and expert opinion. No distinction is made between the different types of slings (retropubic, transobturator, and single-incision MUS).

A structured review was conducted by searching PubMed using (((“Suburethral Slings”[Mesh] OR “Prostheses and Implants”[Mesh:noexp] OR Suburethral Sling\*[tiab] OR suburethral tape\*[tiab] OR Midurethral sling\*[tiab] OR midurethral tape\*[tiab] OR Urethral Sling\*[tiab] OR urethral tape\*[tiab] OR Transobturator Tape\*[tiab] OR Trans-Obturator Tape\*[tiab] OR Tensionless Vaginal Tape\*[tiab] OR Tension-Free Vaginal Tape\*[tiab] OR tension free sling\*[tiab] OR tension free tape\*[tiab])) AND (“Urinary Retention”[Mesh] OR Urinary retention[tiab] OR urine retention[tiab] OR bladder neck obstruction[tiab] OR Voiding dysfunction[tiab] OR bladder outlet obstruction[tiab])). Filter: from 1 January 1996.

Levels of evidence were assessed using the scale of the Oxford Centre for Evidence-based Medicine—Levels of Evidence. Recommendations, where appropriate, were graded based on the levels of evidence.

## Evaluation

In the absence of symptoms, assessment of PVR is mandatory before patient discharge following MUS. Ultrasound use (bladder scanning), despite its inherent margin of error, should suffice to estimate PVR, as it avoids the discomfort and infection risks associated with catheterization. Despite the fact that MUS is the most extensively researched continence procedure, there is no universal definition of an abnormal PVR. Most clinical trials reported PVR >100–150 ml as indicative of VD. A major drawback of this definition is that it does not relate PVR to the voided volume. Thus, some researchers calculate the PVR as a percentage of the total bladder volume (before voiding), and arbitrarily consider a certain threshold (such as one third) as being indicative of VD [6].

Review of the pre-operative voiding patterns of women before MUS is helpful, although studies evaluating objective urodynamic parameters to predict post-MUS VD yield inconsistent results [6].

Intraoperative circumstances (such as tissue injection with large amounts of fluids), postoperative psychosocial distress, pain, a persistent anesthetic effect, and narcotic intake can all lead to temporary VD that is likely to resolve with a conservative approach [7].

Irrespective of the time onset of post-MUS VD, a detailed targeted examination is recommended. Vaginal collection/hematoma, perineal induration, a neglected intravaginal pack or a full rectum can all interfere with normal micturition. The finding of a nonmobile bladder neck on Valsalva, if not

present preoperatively, points to the possibility of mechanical obstruction with MUS [7].

A urinary infection needs to be ruled out, as symptoms could mimic VD. Cystoscopy and/or bladder ultrasound are indicated whenever there intravesical MUS is suspected, especially in cases of severe irritative voiding [3].

The value of UDS is questionable in establishing the etiology of VD, and most surgeons rely on the temporal relationship between the MUS procedure and symptomatology to establish a causative link. In a study evaluating UDS in 302 women with VD post-SUI surgery, five different pressure-flow patterns were identified, and there was no added benefit to the clinical evaluation [8]. Furthermore, urodynamic findings in women with post-MUS VD were not found to be useful in predicting the outcomes after surgical interventions to treat VD [9].

One prospective observational study used ultrasound to measure the distance between the sling and the longitudinal smooth muscle layer of the urethra. It was postulated that early intervention might be implemented to relieve VD if the distance is <3 mm [10], but this approach was not evaluated in other studies.

## Management

Most cases of post-MUS VD improve or resolve over a short period of time. In a secondary analysis of the prospective TOMUS trial including 600 women, the frequency of VD decreased from 20% on the 1st postoperative day, to 6% on day 14, and 2% by the 6th postoperative week [11]. Interestingly, a repeat voiding trial in that study correlated with higher objective SUI cure rate 1 year postoperatively.

## Pharmacotherapy

In women with VD and predominant OAB symptoms, antimuscarinic or  $\beta_3$ -agonist medications can be considered for temporary symptomatic relief, provided that retention or a high PVR is ruled out [12]. Alpha blockers, which relax the urethral smooth muscles, have not been studied in post-MUS VD. Nevertheless, they have been empirically used to decrease outlet resistance when the obstructive symptoms are mild following MUS or other pelvic floor surgeries [7].

## Pelvic floor physiotherapy

Pelvic floor physiotherapy targeting relaxation of the pelvic floor, with or without biofeedback, has also been used in some cases of post-MUS VD, when definitive anatomical obstruction is not the cause. Expert opinion suggests that these

measures tend to work best in patients with a delayed or prolonged urinary stream, slightly elevated PVR, or mild urgency/frequency symptoms [7].

### Catheterization

In women with severe VD or total retention, some surgeons recommend a period of bladder rest (24–36 h with an indwelling catheter), whereas others prefer a catheter with a flip/flow valve and a clamp/release every 3–4 h. There is no clear evidence to support or refute any of the above options.

Clean intermittent catheterization (CIC) is an acceptable first-line treatment option if retention or clinically significant VD with elevated PVR is noted. CIC can be used both as a short-term or a medium-term option, but it can also be offered as a reasonable long-term option to patients who prefer to avoid an additional surgical intervention and the consequent risk of recurrent SUI [7]. Small case series confirmed that up to 80% of women with moderate to severe VD resume normal voiding following 12 weeks of CIC, with comparable voiding patterns at 1 year with those who did not suffer from post-MUS VD [13–15]. In fact, some surgeons advocate teaching self-CIC preoperatively in women suspected to be at risk for postoperative VD.

### Urethral dilatation

Urethral dilatation (UD) continues to be practiced by many surgeons to improve post-MUS VD, despite the lack of evidence. Initial reports described good outcomes when this technique is performed one time or more, 2 days to 6 weeks postoperatively [16, 17]. It was postulated that the dilator would move the freshly inserted unfixed MUS, thus loosening its tension. Such an effect can be augmented by actually pushing the dilator in the urethra downward (posteriorly). Despite a reported 85% success rate, the actual efficacy could not be determined owing to lack of a control group; and it is not known whether improvement is just a function of time rather than a response to the procedure. UD was found by many to be futile in improving post-MUS voiding dysfunction, and consequently abandoned, as the “less invasive” initial surgical intervention to restore normal voiding [18, 19]. Even in an office setting, UD is not an innocuous procedure. In addition to the well-known complication of urinary infections, urethral mesh erosion has been reported following UD in this specific indication [20].

### Surgery

When conservative measures fail, surgical intervention can be contemplated; the options include sling mobilization (loosening), sling incision (midline or lateral; uni- or bilateral), partial or complete excision, and urethrolysis. Optimal timing of

surgical intervention is controversial, but some emphasize that earlier surgical intervention may decrease irreversible detrusor damage, and make sling identification easy before tissue scarring [17].

In patients with symptoms of severe post-MUS VD, sling mobilization could be an appropriate intervention. Expert opinion suggests that the technique is mostly successful when performed in the acute setting, within 2 weeks of the MUS insertion and before any significant tissue ingrowth [3]. Under local anesthesia, the previous vaginal incision is re-opened. After identifying the sling, a right-angled clamp can be used to hook the MUS. Downward traction is then applied to displace the MUS downward for approximately 1–2 cm, ensuring that the actual sling is being pulled, rather than the mesh fibers being stretched [15]. The procedure is not standardized, but a reasonable aim is to allow 5 mm of “free space” between the sling and the urethra [15].

To circumvent repeat surgery (for mobilization) in the case of VD after MUS, some surgeons place a suture loop along the midpoint of the sling during the initial surgery, and exteriorize it to the vaginal lumen, so that it can be grasped and used for traction of the sling during the first 3 days if necessary [21].

Midurethral sling mobilization has a success rate of approximately 90%, with immediate restoration of normal voiding, and without recurrence of SUI in most patients [10, 14, 22–24]. A large Norwegian study of 585 women showed that early sling mobilization was more successful in treating post MUS VD compared with CIC and sling/MUS incision [25].

Various methods of MUS incision have been described, including midline, unilateral, and bilateral techniques. After a small suburethral sagittal incision of the vaginal epithelium is made, the sling is identified and isolated. With a slightly opened clamp placed underneath the sling, the sling can be incised in the midline, unilaterally, or bilaterally [2, 26]. MUS incision has a short recovery time and low morbidity [2], and allows restoration of voiding in over 90%, but is nevertheless associated with the risk of recurrent SUI in 9–61% of cases [15, 18, 27–34].

The decision to limit surgery to a simple incision or to excise a portion of the MUS remains a point of debate. It is the opinion of many that if the MUS incision alone does not appear to adequately “free” the urethra appreciably and the concern for continued retention remains, then partial MUS excision can be a reasonable option provided the patient accepts the risk of SUI recurrence. Furthermore, if the index operation (initial MUS placement) has been more than 3 months, scar formation and local tissue integration may well preclude the simple incision option and partial MUS excision may be the only feasible surgical route [34, 35].

Several procedures have been described whereby excision of the midline part of the MUS and complete excision of the sling laterally up to the point of its entry into the endopelvic

fascia is performed [3]. In all cases, one has to make an incision in the vagina to reach the central part of the sling. Depending of the extent of the excised portion, the edge of the sling is grasped and dissected sharply and bluntly until the pubic arch or obturator foramen is reached [3]. Urinary retention often resolves after sling excision; however, complete removal of the sling can also lead to a significant increase in the rate of recurrent SUI [36].

Urethrolisis is a more invasive surgical procedure that is reserved for patients with multiple continence procedures, or those in whom previous sling revision surgeries failed. It is usually performed transvaginally, although it can be performed abdominally or via a combined approach. A midline or inverted “U” incision approximately 3 cm along the anterior vaginal wall is used. The retropubic space is entered, and the urethra is completely dissected and freed both anteriorly and posteriorly all the way to the bladder neck [37]. A Martius flap can be placed dorsal to the urethra to prevent scarring. As this procedure is described in small case series by experienced surgeons, its outcome—including associated risks—cannot be consistently evaluated.

#### The timing of surgical intervention for best results

Early recognition and management of postoperative VD may prevent irreversible detrusor damage, i.e., hypertrophy or ischemia and denervation through overdistension. Experimental long-term urethral obstruction in rats was shown to lead to an end-stage decompensated bladder, where collagen deposition negatively affects detrusor contractility [38].

In post-MUS VD, there are two arguments for early MUS mobilization. The first is the difficulty of performing the mobilization with time, because of tissue ingrowth. This would then entail sling incision or excision at a later date, thus carrying at least a moderate risk of recurrent SUI, and the possibility of urethral trauma due to scarring. The second is that delayed surgical intervention for post-MUS VD may not improve storage symptoms, as longstanding obstruction of the urethra can have an irreversible impact on the structure and function of the bladder. In fact, persistent OAB symptoms following MUS revision are common [33, 39–41], and de novo OAB symptoms were described in one study when MUS revision was delayed >70 days [42]. Retrospective analysis of patients who underwent MUS revision for VD suggest that a delay beyond several months from the index surgery was associated with a higher likelihood of persistence of OAB symptoms, compared with an “earlier” revision [40, 42, 43], albeit at a lower risk of recurrent SUI [42, 44].

#### Recurrent SUI after sling revision (incision/excision)

One major concern with surgical intervention for post-MUS VD is the risk of recurrent SUI, which was found to range

between 9% and 61% [30, 33, 40, 43–45]. Although some investigators could not correlate the method of sling revision with the risk of development of recurrent SUI [46], others found a 6-fold increase in the risk of recurrent SUI with MUS excision compared with MUS incision [47]. There are conflicting results regarding the effect of elapsed time between the index surgery and the sling revision on the risk of recurrence of SUI [40, 42, 44, 48].

De novo UUI following sling revision is also a concern, as it can occur in up to 43% of cases, and can accompany recurrent SUI as well [41, 42].

It is prudent to perform UDS in recurrent SUI before contemplating therapy in this population. SUI following sling revision for VD often coexists with detrusor overactivity and abnormal voiding patterns [49].

Treatment options of recurrent SUI after sling revision include conservative measures and surgical interventions. There are no data that describe the outcome of such interventions specifically in the scenario of sling revision for VD. A systematic review of interventions for recurrent SUI in general concluded that the objective cure rates of colposuspension, MUS, pubovaginal sling, and bulking agents are 76%, 66%, 79%, and 31% respectively [50].

## Conclusions

The following statements are assigned levels of evidence and grades of recommendation according to the Oxford Centre for Evidence-based Medicine—Levels of Evidence [51]:

1. Symptoms of VD following MUS can range from complete retention to mild voiding pattern alterations. There is no standard classification of types and degrees of post-MUS VD, leading to difficulty in comparing and interpreting the evidence.
2. Clinical diagnosis is the norm; however, the current practice is quite variable. The value of UDS in diagnosis confirmation or management planning has not been established (level 2c evidence).
3. Most cases of post-MUS VDs are temporary. Treatment options for medium- and long-term VD are limited, but should be tailored to patients’ needs and circumstances.
4. Clean intermittent catheterization is a reasonable short-term treatment option. CIC can be used long term in women who do not accept the risk of recurrent SUI in the case of sling revision (grade C recommendation)
5. There is no evidence supporting the use of UD in the treatment of VD post-MUS. UD is to be avoided, especially when remote from the index surgery (grade C recommendation).
6. Early MUS mobilization (loosening) is associated with a high success rate in resolving post-MUS VD, with a

significantly lower risk of recurrent SUI compared with MUS incision/excision (grade c recommendation).

7. When surgical revision of MUS is undertaken, there is no clear evidence to favor either incision or excision with regard to relief of VD, or the risk of SUI recurrence (level 4 evidence)
8. Bladder storage symptoms may persist after sling incision/excision, especially if the intervention is done remotely from the index surgery (level 3b evidence)

#### Compliance with ethical standards

**Conflicts of interest** Abdel-Fattah previously received fees for lectures and/or training courses from Bard, Coloplast, AMS, Pfizer, and Astellas. None of the other authors has any conflicts of interest.

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