

# Prevention, diagnosis, and management of midurethral mesh sling complications

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## Abstract

Midurethral slings (MUS) are a proven effective treatment option for stress urinary incontinence (SUI) and have become the gold standard in most centres in North America. MUS implantation can be associated with risks that are common to all anti-incontinence surgeries, and others which are unique. This article reviews the intraoperative and the early and late postoperative risks associated with these procedures, with insights into their prevention, diagnosis, and management drawn from the literature and expert opinion. In most cases, careful patient counselling before and after surgery, along with meticulous surgical technique, can mitigate risk and patient concern. Even in the best of hands, however, complications will occur, so surgeons must have a high index of suspicion and a low threshold to investigate.

## Introduction

Stress urinary incontinence (SUI) affects a large proportion of females, with some studies estimating between 4–35% of the adult female population.<sup>1,2</sup> Midurethral slings (MUS) are an effective treatment option for SUI after conservative treatments like pessaries and pelvic floor physiotherapy have been attempted.<sup>2,3</sup> MUS procedures have high subjective cure rates ranging from 64–97% at 10-year followup.<sup>2,4,5</sup> Despite their documented efficacy in treating SUI, these devices can be associated with various complications. Studies report that 4% of patients develop one or more complications associated with their MUS procedure.<sup>6,7</sup> Herein, we review the prevention, diagnosis, and management of the potential intraoperative, early (<90 days) postoperative, and late (>90 days) postoperative risks of MUS implantation.

## Intraoperative complications

Intraoperative complications are the result of injury to adjacent structures either during the dissection to place the trocar or during passage of the trocar itself. Many different MUS products are available, including top-down and bottom-up retropubic devices, and outside-in or inside-out transobturator devices. The decision on which device to use may be based on which device a surgeon trained on, which device is available at his or her facility, and occasionally which device is most indicated for a particular patient (i.e., retropubic vs. transobturator). Most surgeons have a preferred device and approach with which they have advanced along the learning curve, a critical point in minimizing complications.<sup>8</sup> In an article by Hilton and Rose, they report that “whilst seductively simple,” the MUS tapes are blind and hard to teach. They suggest that to achieve a <5% bladder perforation rate, a surgeon must complete 20–80 cases.<sup>8</sup>

## Bladder perforation

Intraoperative bladder perforation represents the most common intraoperative complication in MUS surgery and occurs when the trocar is inadvertently inserted into the bladder.<sup>9</sup> Based on the Cochrane review by Ford, this risk is much higher with retropubic (4.5%) vs. transobturator devices (0.6%).<sup>5</sup> It is recommended that surgeons use a cystoscope sheath or catheter with stylet to deflect the bladder neck to the side opposite passage of retropubic trocars to lessen this risk, and evidence suggests that an average of 1.4 cm of displacement can be achieved by this.<sup>10</sup> Suspicion for a perforation should occur if any hematuria is detected during the surgery or if irrigation is seen running from either of the skin incisions. Careful intraoperative cystoscopy is mandatory to diagnose this complication, regardless of which approach is taken to implant the device. The bladder must be fully distended to avoid missing a perforation behind a fold in the mucosa, and a 70-degree lens or flexible panendoscope

should be used. If a bladder injury is noted or the tape is “close” to the mucosa, the surgeon should pass the trocar again more laterally. Typically, a catheter is left for 3–7 days when a perforation has occurred to facilitate bladder healing; however, some surgeons argue that a catheter is not required in simple cases.

### Urethral injury

Urethral injury is a disturbing and preventable complication of MUS surgery; if recognized, the implantation must be abandoned, and if not recognized, it will lead to a potentially devastating mesh erosion. Fortunately, this remains a relatively uncommon complication.<sup>11</sup>

Prior to implanting a MUS, the urethra should be palpated to rule out the rare presence of a diverticulum that could increase the risk of immediate perforation or delayed erosion. The vaginal dissection should be performed with a catheter in the urethra, and must be kept external to the periurethral fascia. We use a #15 scalpel blade to start this dissection to avoid getting too deep with our scissors. Careful cystoscopy with a 30-degree lens or flexible scope must be performed following trocar passage. Should urethral injury occur, it should be repaired with a small absorbable suture (e.g., 4-0 Monocryl or Vicryl), and the mesh should not be implanted. A catheter is left in place for 3–7 days. Despite urethral injury being a significant complication, it is fortunately a relatively uncommon one.<sup>11</sup>

### Vaginal wall button hole

Creation of a button hole in the vaginal wall may occur during initial dissection or during trocar passage. It does not preclude completion of the implantation procedure. Careful creation of the vaginal tunnels with the mucosa on stretch over the surgeon’s finger should limit the likelihood

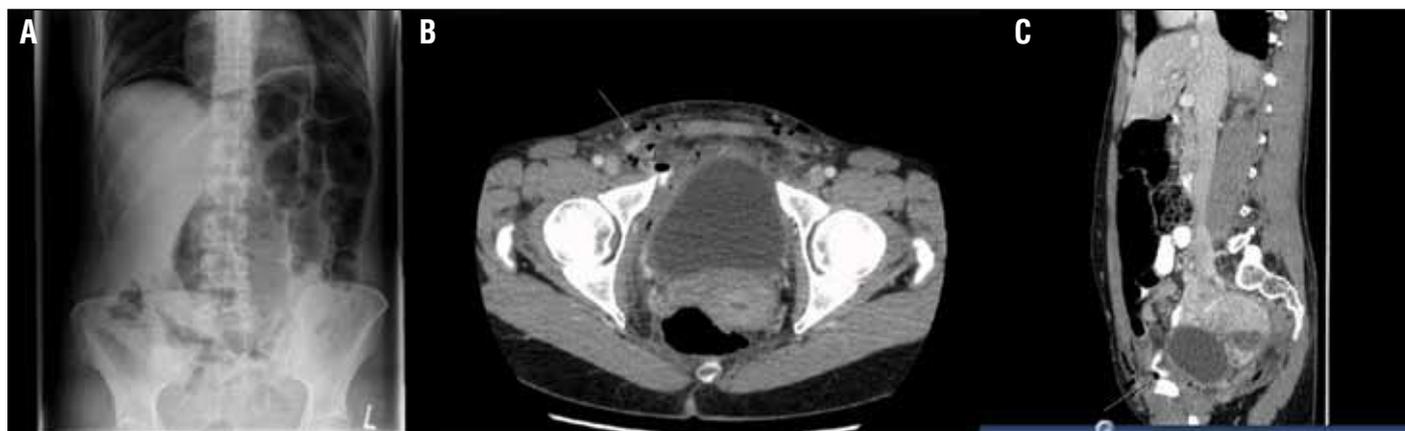
of this event. A vaginal exam should always be performed following trocar passage to check for button holes. If identified during passage of the trocar, then a new pass should be performed, and the vaginal mucosa should be closed following sling tensioning with an absorbable suture. This may require additional effort to ensure adequate lighting and exposure. If vaginal atrophy may have contributed to difficult dissection, consideration should be made for topical estrogen replacement.

### Small bowel injury/perforation

Although rare (0.02% of cases), small bowel injury and perforation represents a serious complication of retropubic MUS surgery.<sup>9</sup> Due to the blind technique required to perform this procedure, bowel injuries may initially be missed, with delays in diagnosis increasing the risk of morbidity and mortality. As a result, a high index of suspicion is critical in diagnosis, and patients presenting with severe abdominal pain with or without fever and drainage from the abdominal incision following MUS should be evaluated for small bowel injury. Patients should be urgently imaged with plain radiographs that may show free air under the diaphragm or computed tomography (CT) if suspicious (Fig. 1). While many urologists might feel comfortable with a laparotomy and small bowel repair, consultation with the general surgery service is encouraged in these situations.

### Neurovascular injury

Awareness of pelvic anatomy is critical for surgeons performing MUS implantation. Although rare, pelvic neurovascular structures, including the obturator nerve and iliac vessels, can be injured during trocar passage.<sup>9,12,13</sup> Both delayed and immediate presentations of these complications are possible and surgeons should be mindful of these whenever a con-



**Fig. 1.** (A) Upright x-ray showing free air under the diaphragm in suspected case of bowel perforation from retropubic midurethral sling; (B) computed tomography (CT) supine; and (C) CT sagittal cuts showing suspected site of small bowel perforation near right pubic ramus.

cern with intra- or postoperative vital signs develops, or in the event of immediate postoperative leg weakness.

More commonly, excessive bleeding may be noted during vaginal dissection that will prove to be self-limited. Often this resolves once the tape is positioned or with vaginal closure. An interlocking suture line is preferred in these instances, and a vaginal pack can be left in situ for a couple of hours at the surgeon's discretion. Finally, a pelvic hematoma will rarely be noticed during cystoscopy as an enlarging extrinsic mass compressing the bladder. In these cases, the patient should be carefully observed postoperatively, but may be discharged if she remains stable. A period of catheterization may be required, and followup imaging should also be considered.

## Early (<90 days) postoperative complications

### Urinary tract infection

Urinary tract infections (UTIs) represent the most common early postoperative MUS complication, with up to 3% of patients developing and being treated for UTI-like symptoms.<sup>6,14</sup> UTIs may be more common in patients older than 65, those with a body mass index (BMI) >40, those who are admitted to hospital, and when the implantation is performed by a gynecological surgeon.<sup>14</sup> A single dose of antibiotic is recommended to be given preoperatively.<sup>15</sup>

UTIs often present postoperatively with the clinical manifestations of dysuria, frequency, urgency, suprapubic pain, and hematuria. UTIs have been shown to be more common in patients who are discharged with an indwelling Foley catheter due to failure to pass a postoperative voiding trial.<sup>16</sup> It is always advised to get a urine culture prior to antibiotic therapy when possible, to confirm the presence of infection. Recurrent postoperative UTIs should raise suspicion for mesh erosion or outlet obstruction and are a risk factor for reoperation.<sup>17</sup> Early cystoscopy is indicated to rule out erosion, along with uroflow study to assess for voiding dysfunction. Urodynamics (UDS) may be considered to diagnose obstruction.

### Urinary retention, elevated post-void residual, and voiding dysfunction

Postoperative voiding dysfunction may result from mechanical bladder outlet obstruction (BOO) (secondary to a tight sling, edema, or hematoma formation), anxiety or pain causing dysfunctional voiding, or exacerbation of pre-existing voiding dysfunction (e.g., detrusor underactivity). Patients should be carefully questioned about their preoperative voiding function, and uroflowmetry is helpful in screening for significant dysfunction. UDS may be indicated when a history and uroflow suggest increased risk for postoperative retention.

The impact of abdominal (Valsalva) voiding on postoperative urinary retention is debated, with some authors suggesting it is an independent risk factor.<sup>18-20</sup> and others reporting that these patients are at no higher risk of retention.<sup>21</sup>

Because urinary retention is rare, most surgeons do not routinely teach self-catheterization (SC) preoperatively other than for high-risk patients; however, it should be instituted in the early days after surgery if voiding dysfunction with an elevated post-void residual (PVR) continues. Persistent voiding dysfunction with PVR remaining above 150 mL may require tape loosening or lysis. Tape loosening is appropriate until 10–14 days' postoperatively, when tissue ingrowth becomes too restrictive to allow loosening. After this, tape lysis should be considered, understanding the risk of recurrent SUI in 25–47% of cases.<sup>22</sup> Having said this, one study suggests that most postoperative voiding dysfunction spontaneously resolves within six weeks of surgery and, therefore, patients can be conservatively managed until this point before a tape release is considered.<sup>23</sup>

### Surgical site infections and vaginal wall concerns

Superficial surgical site infections (SSI) occur rarely, with an incidence of 0.2–0.3%.<sup>6,7,9</sup> The exit sites in the groin or suprapubic region may present with localized erythema, warmth, and pain, and this may be associated with a purulent exudate. Systemic antibiotic treatment and debridement to ensure there is no mesh at the surface is sufficient in most instances. If systemic illness with abdominal pain and/or fever present, then a perforated viscus must be considered in the diagnosis.

Patients should be counselled that vaginal spotting and passage of suture material may occur for several weeks following surgery. For those presenting with concerns about vaginal healing and persistent sutures, reassurance and education that the sutures will dissolve is provided; however, a vaginal exam should be performed to rule out extrusion, button-holing, or delayed healing.

## Late (>90 days) postoperative complications

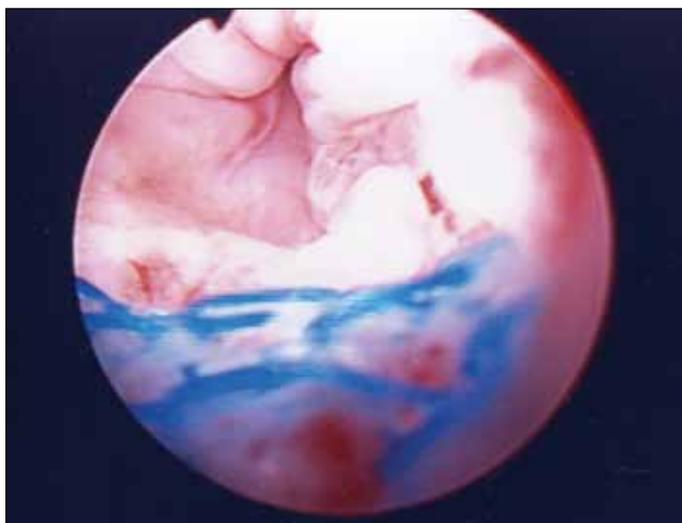
### Vaginal extrusion

Mesh exposure through the vaginal wall represents a relatively common late postoperative complication of MUS. A meta-analysis noted that vaginal extrusion is present in 5% of patients at 10-year followup, and these cases were predominantly asymptomatic.<sup>5</sup> This complication is more common with transobturator tapes.<sup>4</sup> Presentation of vaginal extrusion may include: dyspareunia, hispareunia (partner discomfort), palpable or visible tape in the vagina, pain, and vaginal bleeding/discharge. Diagnosis can be confirmed

with a visual inspection of the vagina, as well as palpation, and treatment varies based on severity of the extrusion and symptoms. Many patients may not require therapy if they are not sexually active or unaware of the finding. First-line conservative treatments include topical vaginal estrogen creams and avoiding any form of vaginal penetration. If symptoms are refractory to first-line treatments, surgery is indicated. This involves reapproximation and repair of the vaginal mucosa with or without mesh excision.

### Erosion into the surrounding structures (urethra, bladder, etc.)

Less commonly, MUS mesh can erode into surrounding structures, particularly the urethra (Fig. 2) and bladder (Fig. 3).<sup>10</sup> These cases may present with recurrent UTIs, hematuria, dysuria, voiding and/or catheterization difficulty (Fig. 4), urinary urgency, and rarely fistula formation (Fig. 5). Erosion into the bladder or urethra is confirmed with cystoscopy, and there should be a low threshold to proceed with this exam. Treatment will vary depending on the severity of the erosion and the structures affected. For urethral erosions, tape lysis and mesh excision are used to prevent further injury to the affected structures. Some experts advise a staged approach with cutting or lasing the tape within the urethra to allow the tape to retract making removal through a transvaginal approach easier in a second stage if required (Fig. 6). If a laser endoscope is difficult to introduce or work with, a pediatric cystoscope can allow one to advance a clamp and/or scissors alongside the scope to access the mesh to cut it. For larger urethral injuries, reconstructive procedures, including urethra-vaginal fistula repair with Martius flap and fascial sling, may be needed, and referral to a subspecialist is encouraged. For bladder erosions, transurethral laser excision with or without a transvesical laparoscopic port for traction have



**Fig. 2.** Uncomplicated distal urethral erosion of midurethral sling mesh. The authors prefer a staged approach with initial endoscopic excision followed by transvaginal excision and urethral repair, as necessary.

been used (Fig. 3), and in some cases transabdominal bladder exploration and open excision may be necessary.<sup>24</sup>

### Refractory leakage and de novo urinary urgency

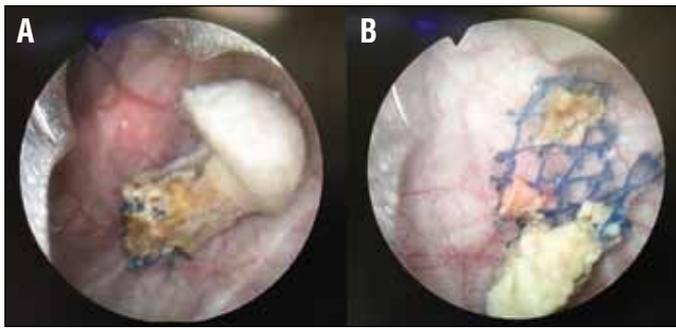
UDS prior to MUS procedures are useful in patients with mixed incontinence to document OAB and SUI upfront. This allows for counselling patients about the treatment options for each condition. In most instances the urgency component is addressed first, given that it is usually the most bothersome symptom, and that its treatment is usually medical and immediately available.

The patient who presents for followup assessment or second opinion stating that her surgery “didn’t work” can be a challenge. Refractory leakage can be caused by several etiologies, including persistent SUI and persistent or de novo overactive bladder (OAB). At times, the cause may be readily apparent; however, history, validated questionnaires, physical exam, cystoscopy, and UDS can all be employed to sort out the “still leaking” patient. A relatively common postoperative complication of MUS is de novo OAB with or without urgency incontinence.<sup>2,5,25</sup> A recent study found de novo OAB to be present in 26% of patients at 10-year followup from MUS surgery.<sup>5</sup> Whether OAB represents a postoperative complication or an underlying independent condition is difficult to distinguish. Both de novo OAB and persistent OAB are treated with anticholinergic medications, beta-3 agonists and/or onabotulinumtoxin A bladder injections after UDS has ensured the patient is not obstructed (Fig. 7). For patients with de novo OAB and obstruction, tape lysis should be performed.

Refractory leakage due to SUI can also occur in MUS patients. For these patients, most experts advocate either a repeat MUS or an alternate approach, such as an autologous fascial sling.<sup>26</sup> This subject is addressed in detail elsewhere in this supplement.



**Fig. 3.** Retroflexed view showing large segment of midurethral sling mesh visible beneath the bladder mucosa. Note the stone formation on a single strand of mesh that had fully penetrated through to the bladder lumen. This case was treated by transurethral Holmium laser excision using a laparoscopic grasper via a 5 mm suprapubic port, with complete resolution of overactive bladder symptoms and pelvic pain.



**Fig. 4.** Urethral mesh erosion with stone formation. This patient presented with urinary retention and inability to self-catheterize seven years following midurethral sling implantation. **(A)** The mesh entering the urethral lumen on either side has been transected using a Holmium laser, releasing a large mushroom-shaped stone that had completely obstructed the proximal urethra and bladder neck; **(B)** laser cystolithopaxy reveals the underlying midurethral sling mesh.

### Delayed voiding dysfunction

In some instances, voiding dysfunction, urinary retention, or recurrent UTIs are not brought to attention until many weeks, months, or years after surgery. In these instances, the most critical aspect of diagnosis is to determine a temporal relationship between the presenting complaint and implantation of the MUS. If this can be determined definitively, then tape lysis should be offered, again acknowledging the potential risk of nearly 50% for recurrent SUI.<sup>22</sup> If not, then UDS are indicated to confirm BOO on pressure-flow study (e.g., Qmax 15 ml/sec with PdetQmax 20 cmH<sub>2</sub>O).<sup>27</sup> Often these cases also present with symptoms of OAB and/or recurrent SUI. Patients should expect improvement in voiding in more than 90% of cases and resolution or improvement of OAB in 50–70%.<sup>28,29</sup>

### Pain

Postoperative chronic pelvic pain has been reported in the literature as a late postoperative complication and is more common following a transobturator approach.<sup>2,4,11</sup> Patients typically present with groin discomfort or the sensation of pulling. Treatment of chronic pelvic pain in this setting is beyond the scope of this article, but may include observation, analgesic medications, and complete mesh excision. Treatment options are dependent on the severity of symptoms. Patients should be reviewed to ensure that there are no overt complications causing the pain, such as vaginal wall extrusion or erosion into the surround structures. These cases can be extremely difficult to manage and involvement of a multidisciplinary team, including physiotherapists and/or a dedicated pain centre, is helpful. New areas of research are being explored, including the possibility that pain is associated with infection of the mesh.<sup>30</sup>



**Fig. 5.** Complex urethral midurethral sling mesh erosion with stone formation and fistulization through the vaginal wall. This case required upfront formal transvaginal excision and urethral repair.

### Patient concern/anxiety surrounding surgical mesh

An unconventional postoperative “complication” that we have noted in our practice is the presentation of patients with postoperative anxiety regarding surgical mesh. Despite extensive efforts at providing informed consent preoperatively, some patients become uneasy with the use of surgical mesh and wish to have it removed. The rate at which this occurs is difficult to quantify. For these patients, one must try to address the concerns and identify the cause of unease. We attempt to educate the patient and pursue a conservative treatment course.<sup>31</sup>

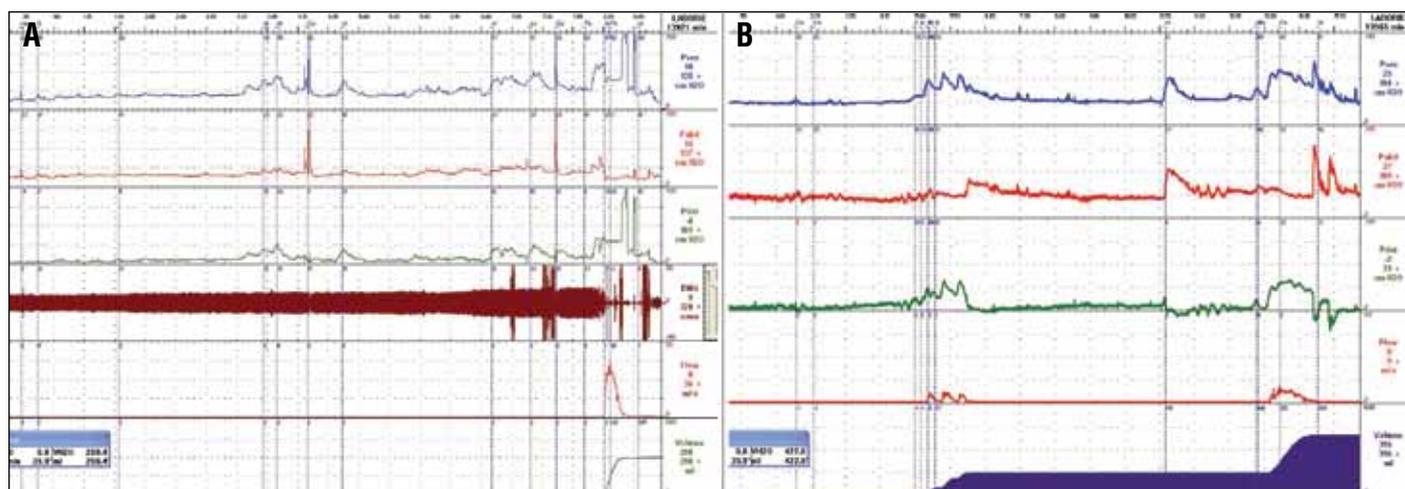
### Conclusion

This article characterizes the potential risks associated with MUS in the treatment of SUI. Patients should be aware and well-informed of these complications before proceeding with MUS implantation. Despite them, MUS surgery remains the most definitive treatment options for SUI, with a relatively low rate of complications. Maintaining a low index of suspicion and addressing complications quickly usually allows for a quick recovery.



**Fig. 6.** Endoscopic view six weeks following endoscopic excision of uncomplicated urethral erosion. Note that only a few mesh strands are barely visible in the urethral lumen. The patient is now symptom-free. These are easily extracted via a subsequent transvaginal approach, simplifying urethral repair.

**Competing interests:** The authors report no competing personal or financial interests relevant to this review.



**Fig. 7. (A)** Unobstructed detrusor overactivity (DO) following midurethral sling implantation. This patient was managed initially with an oral overactive bladder agent; **(B)** obstructed DO following midurethral sling; this patient required sling lysis.

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