Management of iatrogenic urethral foreign body after mid-urethral sling

A literature review

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ABSTRACT

INTRODUCTION: Urethral mesh perforation is a rare complication of mid-urethral sling resulting in a lack of clear management guidelines. Thus, we aimed to determine management options and their respective outcomes in terms of erosion resolution and continence.

METHODS: A literature review was performed by extracting studies from the PubMed, Cochrane, and Google Scholar from January 1996 to December 1, 2022. Only French and English language studies were included. A total of 227 papers were screened and assessed for eligibility.

RESULTS: Forty-eight studies were included in the final analysis, for a total of 224 patients. Treatment options consisted of conservative, endoscopic, transurethral, and transvaginal approaches. Conservative treatment was associated with a 100% risk of persistence or recurrence of urethral perforation, while the failure rates for endoscopic, transurethral, and transvaginal approaches were 33%, 7.5%, and 7%, respectively. Most patients suffered from stress urinary incontinence after reconstructive management. The most common symptoms at the time of presentation were overactive bladder and pain. The mean time between the onset of symptoms and diagnosis was 10 months. About half of the urethral mesh perforations were diagnosed within the first years after the initial sling insertion.

CONCLUSIONS: Multiple management options for sling penetration of the urethra have been described in the literature. Transvaginal sling resection with consecutive tissue interposition seems to carry the lowest risk of erosion recurrence; however, all treatment options are associated with a high relapse rate for stress urinary incontinence.

INTRODUCTION

Since their introduction to the market in 1996, mid-urethral synthetic slings (MUS) have seen an impressive growth and are used worldwide for the treatment of stress urinary incontinence (SUI) in women.[1] After a gradual increase in the late 1990s up to 2010, their use declined slightly when the FDA, as well as Health Canada, issued warnings in February 2010 and July 2011, and later an update in March 2013 and May 2014;[2-5] however, they still remain the most common incontinence management procedure today.[6] Today, awareness of MUS complications has increased due to several national registries worldwide, as well as numerous case reports, cohort studies, and reviews.

Perforation is a rare complication of tension-free transvaginal tape (TVT). Vaginal exposure and vesical or urethral perforation occurs in about 2% and <0.5%, respectively.[7-9] Several risk factors have been reported to increase the rate of urethral perforation, including the non-recognition of urethral perioperative trocar injury, excessive tension, MUS twist, dissection that is too close to the urethra or too extensive, and impaired blood supply, such as in menopausal women or after local radiotherapy. Patients undergoing repeat sling procedure, as well as a postoperative urethral dilatation or transurethral downward tugging, have also been associated with an increased rate of urethral erosion.[10,11]

KEY MESSAGES

- Mid-urethral sling perforation into the urethra can be managed by endoscopic, transurethral, or transvaginal approach.
- Minimally invasive procedures, like transurethral or endoscopic sling resection, are safe and successful for most patients.
- Transvaginal sling complete excision with tissue interposition has the lowest risk of erosion recurrence.
- All approaches are associated with a high relapse rate of stress urinary incontinence.

Possible management of urethral perforation includes transurethral endoscopic, direct transurethral, and transvaginal partial or complete sling excision. Because of the rarity of this complication, there is a lack of clear management guidelines in the literature and thus, the approach chosen is often based on local customs and surgeon experience. By conducting a literature review, we aimed to investigate the specific management outcomes in terms of perforation recurrence, continence, and the need for subsequent surgery. We also sought to identify the symptoms associated with urethral perforation, as well as the timing between the initial MUS insertion and perforation diagnosis.

METHODS

A review of the literature published from January 1996 to December 1, 2022, was performed using different electronic database platforms (PubMed, Cochrane, Google Scholar). Boolean logic was applied to the keywords *urethral erosion, penetration or perforation,* combining them with the following search team: *mid-urethral sling, MUS*, *transvaginal tape*, *tension-free vaginal tape, TVT*, *sling, transobturator tape, TOT*, *management*, *surgery*, *reconstruction,* or *repair*. Furthermore, additional articles were found by hand-searching the reference lists of each article. Two independent reviewers conducted the search and rated the article title and abstract. If no consensus was attained, a third reviewer was available for consultation. Included articles were in English or French, involved adult women (≥18 years of age), and described the treatment approach for urethral erosion and its outcomes. All types of MUS were included, and all treatment options were considered. This included conservative, direct or endoscopic transurethral approach, and transvaginal treatment options. If different locations of urinary tract perforation (bladder, vaginal, or urethral) were reported in an article, we extracted the relevant data separately. The study was rejected if the urethral perforation was concomitant with bladder perforation or recognized at the time of the mesh insertion. Studies were also discarded if the outcome of the surgical repair was not reported.

All identified abstracts were processed using a reference manager software package (EndNote X9, Thomson Reuters, Philadelphia, PA, U.S.).

Data collected from the relevant articles were the year of publication, the study type, the number of patients, their age, the type of MUS, erosion-associated symptoms, the timing between mesh insertion and erosion diagnosis, the type of perforation (partial or transfixing), management, and outcomes, including success rate, continence, and need for further surgery. A partial perforation was defined as a visible sling portion within the urethral wall, while a transfixing perforation was defined as the sling crossing the lumen of the urethra. Success was defined as the absence of persistent or recurrent tape perforation at followup appointments.

RESULTS

Search results

The results of the literature search are shown as a flow chart in Figure 1. After identifying 227 articles during the initial search and an additional 16 studies by hand-searching the articles' reference lists, we excluded 135 articles after title and abstract review and another 55 after full-text assessment. A total of 48 papers were included in the final analysis (Table 1).

Characteristics of the studies and patient population

We found 27 case reports[12-38] and 21 retrospective studies.[11, 39-58] Study characteristics were categorized according to the management options used: conservative (Table 2), transurethral (Table 3), and transvaginal (Table 4).

A total of 224 patients were included, with a median of two patients per study and a mean age of 54.9 years. Most patients received a retropubic MUS (RP-MUS) (60%) and the most common symptoms associated with MUS perforation were irritative symptoms (65%) and SUI recurrence (51%), while 12% of erosions were associated with urethrovaginal fistula. Mean followup

after perforation management was 16 months. The demographic data, as well as clinical presentation, are shown in Table 5.

Management outcomes

Overall, the use of conservative management, including observation, suprapubic catheter placement, and antibiotic treatment, was reported in two studies for a total of three patients (Table 2). In all cases, partial perforation occurred in these patients within one year of MUS insertion. According to our review, conservative treatments are associated with a 100% failure rate. The authors cited the frailty of the patients and the desire to avoid surgery as reasons for choosing this approach.

Endoscopic transurethral management methods for urethral perforation were subdivided according to the medium used to cut the sling: holmium laser (endo-L), endoscopic scissors (endo-S), or electrode loop (endo-E). Complete sling transfixion, as well as partial erosion, were addressed by this strategy. The laser approach was used in seven studies for a total of 43 patients and failed in 37% of the patients. Furthermore, 21% of the patients suffered from SUI recurrence afterwards. In the endo-E group, two of four patients (50%) also experienced perforation recurrence and required subsequent treatment. Endo-S resection seems to yield better results, as only one of 11 patients (9%) continued to have persistent foreign bodies in the urethra; however, 55% suffered from recurrent SUI. Endoscopic management outcomes are presented in Table 3.

A direct transurethral approach was used in five studies for a total of 14 urethral perforations. It consisted of grabbing the sling transurethrally with a clamp, applying traction on it, and cutting both mucosal edges of the sling with scissors inserted through the urethra. Both partial and transfixing perforations were managed in this way. Healing without subsequent mesh exposure was archived in 93% of the patients and 36% experienced SUI recurrence. Results are presented in Table 3 .

Most of the studies reported transvaginal management for urethral mesh perforation. Moreover, all patients in whom the perforation presented as a urethrovaginal fistula were managed this way. We identified two principal reconstructive procedures. The first included a partial or complete mesh vaginal portion excision using an inverted "U" or a transversal vaginal incision followed by multilayer closure of the urethral defect and vagina with absorbable sutures. This procedure was used in a total of 65 patients. The surgery was successful in 57 patients (88%). The latter suffered from a persistent urethrovaginal fistula and required subsequent transvaginal surgery with tissue interposition in most cases. SUI recurred in 60% of the patients.

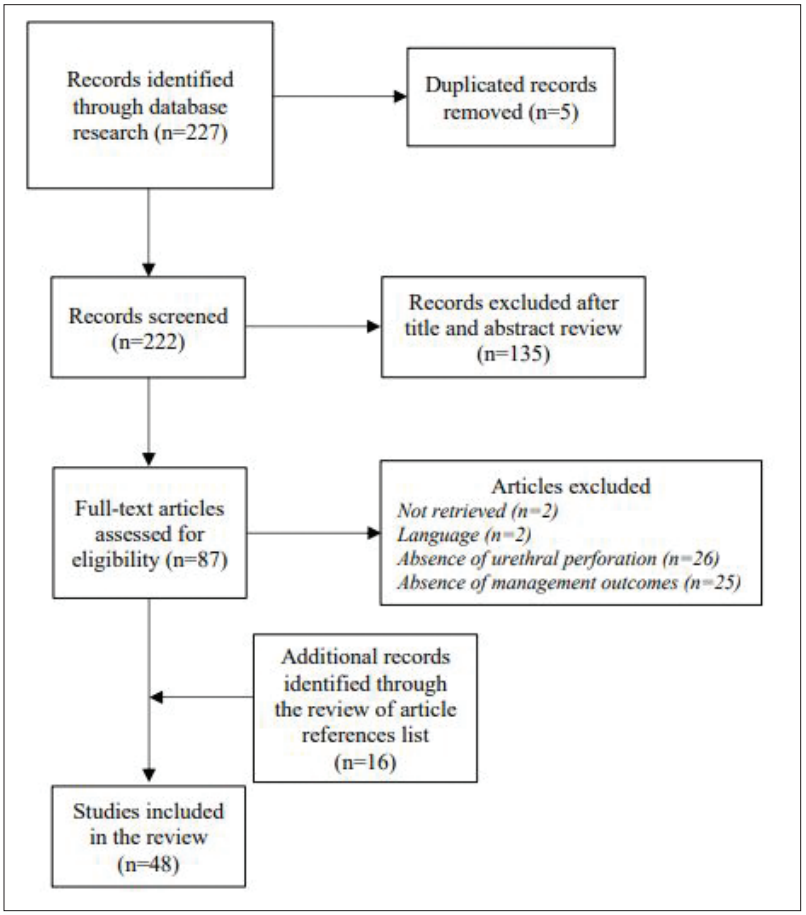

Figure 1. Flow chart of study selection.

The second subtype included the same transvaginal procedures but with the addition of a tissue interposition between the closure of the urethra and the vaginal wall. Such a method was used in 15 studies for a total of 79 patients. Most of them underwent a Martius fibro-fatty flap (n=53) followed by an autologous fascia sling interposition (n=22). Flaps of vaginal epithelium (n=2), omentum (n=1), and striated sphincter fiber (n=1) flaps were also used. When a flap was used, most surgeons advocated complete removal of the vaginal portion of sling material (76%). Overall, two patients (2.5%) experienced failure in the form of a persistent urethrovaginal fistula. SUI after repairs, on the other hand, was frequent and occurred in 39 patients (60%) (Table 4)

Four studies described the management of non-synthetic pubovaginal sling (PVS) perforation for a total of 14 patients. One patient had an urethrovaginal

Table 1. Characteristics of the included studies

References	Year of publication	Level of evidence	# of patients
Case reports (n=27)			
Ibrahim et al	2018	VI	1
Pizarro-Berdichesky et al	2016	VI	1
Plowright et al	2013	VI	2
Dillon et al	2012	VI	1
Minaglia et al	2012	VI	1
Estevez et al	2010	VI	2
Mendonça et al	2010	VI	2
Raghavan et al	2010	VI	1
Quiroz et al	2009	VI	1
Wadie et al	2009	VI	1
Wijffels et al	2009	VI	3
Sokol et al	2008	VI	1
Siegel et al	2006	VI	1
Powers et al	2005	VI	2
McLennan et al	2004	VI	1
Tunn et al	2004	VI	1
Wai et al	2004	VI	1
Gerstenbluth et al	2003	VI	1
Hilton et al	2003	VI	1
Vassallo et al	2003	VI	1
Webster et al	2003	VI	1
Werner et al	2003	VI	1
Haferkamp et al	2002	VI	1
Madjar et al	2002	VI	1
Golomb et al	2001	VI	1
Koelbl et al	2001	VI	1
Cholhan et al	1996	VI	1

Table 1 (cont'd). Characteristics of the included studies

References	Year of publication	Level of evidence	# of patients
Retrospective studies (n=21)			
Allagany et al	2022	VI	29
Hermieu et al	2022	VI	15
Toia et al	2022	VI	34
Goujon et al	2018	VI	3
Kowalik et al	2018	VI	19
Colhoun et al	2016	VI	5
Ogle et al	2015	VI	4
Sergouniotis et al	2015	VI	8
Blaivas et al	2014	VI	4
Forzini et al	2014	VI	3
Reisenauer et al	2013	VI	7
Shah et al	2013	VI	14
Doumouchtsis et al	2011	VI	4
Jo et al	2011	VI	3
Velemir et al	2008	VI	7
Baracat et al	2005	VI	5
Hammad et al	2005	VI	9
Glavind et al	2004	VI	1
Amundsen et al	2003	VI	9
Sweat et al	2002	VI	2
Clemens et al	2000	VI	6

fistula associated with the perforation. A transvaginal approach associated with sling division only, partial excision, or complete excision was used in seven, one, and five patients, respectively. None of them had undergone flap interposition. One patient was treated with a direct transurethral excision, according to the technique

Table 2. Conservative management

	# (n=3)	Mean age (44.8)	MUS type	Symptoms	Perforation type	Mean erosion timing (4.8 m)	Persistence of erosion 3/3 (100%)	Subsequent treatment
Golomb (2001)	1/1	46	Non-syn. sling	Pain	Partial	7	1	Transvaginal excision
Sergouniotis (2015)	2/8	43.5	SIS (1), TVT (1)	None (1), Pain/ OAB (1)	Partial	2.5	2	Transurethral excision (1), Observation (1)

MUS: mid-urethral sling; SIS: single-incision sling; TVT: tension-free vaginal tape.

Table 3. Endoscopic and transurethral management

	#	Mean age	Type of erosion	Mean erosion timing (m)	Mean followup (m)	Outcomes		Subsequent treatment
						Persistence of SUI	Persistence of erosion	
Endo-L	43	63		33.6	16.3	9/42 (21%)	16/43 (37%)	
Allagany (2022)	29/29	58	Transfixing (9)	72	3	6	8	Observation (5), re-endo-laser (3)
Kowalik (2018)	1/19	73	–	–	–	–	1	Transvaginal excision
Ogli (2015)	4/4	63	–	46	29	1	2	TVT (1), re-endo-laser (1)
Forzini (2014)	3/3	65.7	Transfixing	10	33	1	2	Transvaginal excision (1), re-endo-laser (1), lost in followup (1)
Dillon (2012)	1/1	58	Transfixing	36	1.5	0	0	None
Jo (2011)	1/3	57	–	–	–	1	1	Observation
Doumouchtsis (2010)	4/4	68.3	–	4	15	0	2	RTU-laser (1)
Endo-E	4	56				1/2 (50%)	2/4 (50%)	
Kowalik (2018)	2/19	61	–	–	–	–	2	Transvaginal excision (2)
Jo (2011)	1/3	67	–	–	–	0	0	None
Wadie (2009)	1/1	40	Transfixing	120	2	1	0	Non-synthetic sling
Endo-S	11	66		19	8	6/11 (55%)	1/11 (9%)	
Velemir (2008)	4/7	53.5	–	53.5	11.3	3	1	TOT (1), para-urethral bulking agent (1), re-TUR (1)
Baracat (2005)	5/5	–	–	8	6	3	0	non-synthetic sling (3)
McLennan (2004)	1/1	77	Partial	1	10	0	0	None
Werner (2003)	1/1	68	Transfixing	14	6	0	0	None
TU-S	14	52		40.5	8.4	5/14 (36%)	1/14 (7%)	
Sergouniotis (2015)	6/8	45.3	Partial (4), Transfixing (1)	60.7	5.2	3	1	TVT (3), observation (1)
Plowright (2013)	2/2	55	Transfixing	48	30	0	0	None
Mendonça (2010)	2/2	57	Transfixing	12	3	1	0	None
Quiroz (2009)	1/1	50	Transfixing	72	1.5	0	0	None
Wijffels (2009)	3/3	52	Transfixing	10	2.5	1	0	TVT (1)

Endo-E: electrode loop; Endo-L: holmium laser; Endo-S: endoscopic scissors; SUI: stress urinary incontinence; TUR: transurethral resection; TU-S: transurethral sling; TVT: tension-free vaginal tape.

described previously. Regardless of the technique used, a success rate of 100% was archived but six patients (43%) subsequently suffered from SUI (Table 6)

Stress urinary incontinence

SUI status was available before and after perforation management in 141 patients. Of those suffering from SUI at the time of reference, 79% had SUI persistence, while 21% were cured after urethral perforation repair.

Table 4A. Urethrotomy with mesh excision alone, n=65

	#	Mean age (51.5 yrs)	Mean erosion timing (21.2 mos)	Mesh excision extends	Mean followup (15.9 mos)	Outcomes		Subsequent treatment
						Persistence of SUI 39/65 (60%)	Persistence of erosion 8/65 (12%)	
Hermieu (2022)	15/15	57	43	Partial	12	12	0	TVT (5), AUS (1), Burch (1), bulking agents (1)
Goujon (2018)	2/3	58.5	78	-	92.5	2	1	Redo + vaginal flap (1)
Kowalik (2018)	10/19	55	–	Partial	25	4	0	Non-syn. sling (1), redo + flap (1)
Colhoun (2016)	5/5	49	4.2	Complete	54	4	0	Non-syn. sling (3)
Pizarro-B (2016)	1/1	66	12	Partial	8	0	0	None
Sergouniotis (2015)	2/8	51	4	Partial	3	2	0	Colposuspension (1), bulking agents (1)
Reisenauer (2013)	7/7	54	40	Partial	11	6	Fistula (5)	Redo (1) + re-do + flap (4)
Jo (2011)	1/3	60	–	Partial	–	0	0	None
Estevez (2010)	2/2	42	29.5	Complete	13	2	0	TVT (1)
Raghavan (2010)	1/1	54	72	Partial	–	0	0	None
Velemir (2008)	1/7	48	3	Complete	3	0	0	None
Hammad (2005)	5/9	–	–	Partial	–	0	0	None
Powers (2005)	2/2	42	3.5	Complete	1.5	2	0	None
Glavind (2004)	1/1	56	3	Partial	12	1	Fistula (1)	Abdominal repair (1)
Tunn (2004)	1/1	43	8	Partial	1.5	0	0	None
Wai (2004)	1/1	54	5	Partial	-	1	0	None
Amundsen (2003)	1/9	–	18	Partial	39	1	0	Bulking agents
Vassallo (2003)	1/1	36	3	Partial	1	1	0	Non-syn. sling
Haferkamp (2002)	1/1	56	1	Partial	1	0	0	None
Madjar (2002)	1/1	55	3	Complete	3	0	0	None
Sweat (2002)	1/2	–	–	Partial	–	1	Fistula (1)	Redo + flap (1)
Koelbl (2001)	1/1	45	12	Partial	0.5	0	0	None
Cholhan (1996)	1/1	50	24	Partial	5	0	0	None

AUS: artificial urinary sphincter; IC: ileal conduit; SUI: stress urinary incontinence; TVT: tension-free vaginal tape.

Moreover, 19% developed de novo SUI after management. Of those, 91% and 9% underwent a transvaginal and a transurethral perforation repair, respectively.

Timing

Time between initial MUS insertion and the development of symptoms was reported in 45 patients and the time between initial surgery and the perforation diagnosis in 96 patients. Half of the perforations occurred within the first year after MUS surgery. The occurrence of urethral mesh perforation after six years was rare (10%) (Figure 2). When urethral perforation occurred within the first year, half of the patients complained of symptoms since the MUS insertion. Mean delay between the onset of symptoms and diagnosis of perforation was 10 months.

Table 4B. Urethrotomy with mesh excision and flap, n=79

	#	Mean age (55.5)	Mean erosion timing (30.8 mos)	Mesh excision extends	Flap	Mean followup (11 mos)	Outcomes		Subsequent treatment
							Persistence of SUI 45/75 (60%)	Persistence of erosion 2/79 (2.5%)	
Toia (2022)	34/34	53	72	Complete	Martius	6	28	Fistula (1)	Non-syn. sling (13), IC (1), AUS (2), bulking agents (1), colposuspension (4)
Goujon (2018)	1/3	72	11	Complete	Martius	9	1	0	None
Ibrahim (2018)	1/1	54	144	Complete	Martius	3	0	0	None
Kowalik (2018)	10/19	56	–		Martius (2), autologous sling (7), vaginal (1)	25	7	0	Non-syn. sling (1)
Blaivas (2014)	4/4	–	15	-	Martius (3), Omentum (1)	-	-	Fistula (1)	Autologous sling (4)
Reisenauer (2013)	4/7	49.5	18	Partial	Martius (4)	9.5	3	0	TVT (2)
Shah (2013)	14/14	53	18	Complete	Autologous sling (14)	16	1	0	Non-syn. sling (1), sling lysis (1), urethroplasty (1)
Minaglia (2012)	1/1	42	26	Complete	Martius	2.5	1	0	None
Sokol (2008)	1/1	50	12	Complete	Sphincter fiber	8	0	0	None
Velemir (2008)	2/7	55	5	Complete	Martius (2)	12	1	0	Bulking injection (1)
Siegel (2006)	1/1	64	0	Complete	Martius	3	1	0	Non-syn. sling (1)
Amundsen (2003)	2/9	-	7	Partial	Martius (2)	34	1	0	Non-syn. sling (1)
Gerstenbluth (2003)	1/1	70	60	Complete	Martius	3	0	0	None
Hilton (2003)	1/1	48	12	Complete	Martius	–	1	0	None
Sweat (2002)	2/2	–	–	Complete	Martius (1), autologous sling (1)	12	0	0	None

AUS: artificial urinary sphincter; IC: ileal conduit; SUI: stress urinary incontinence; TVT: tension-free vaginal tape.

DISCUSSION

As mentioned earlier, urethral perforation is a rare complication, occurring in less than 0.5% of MUS insertions. Due to the rarity of this event, the literature on the management of such a complication is sparse. Indeed, since the introduction of MUS in 1996, we could only retrieve a total of 224 patients from studies that met our inclusion criteria. Moreover, all included articles were retrospective or case reports, making it impossible to draw strong recommendations about urethral erosion management; however, we believe this review can still provide sensible general recommendations.

First, it seems that conservative management is neither an appropriate nor effective option, and we recommend not offering it to patients. Indeed, our study suggests a high risk of erosion persistence and a high likelihood of the need for subsequent intervention. Even in patients with high comorbidity, a minimally invasive approach, such as endoscopic transection, seems preferable, as it provides a satisfactory cure rate and can be performed without general anesthesia. Our statement against conservative management is concordant with the Canadian Urological Association (CUA), as well as the American Urological Association (AUA) guidelines.[59,60]

According to these same sources, sling removal can be performed by endoscopic or transvaginal resection.[59,60] In our review, the use of transurethral scissor, either by an endoscopic or a direct approach, seems to be associated with a higher cure rate than lasers

Table 5. Demographic data and presentation of the urethral erosion

Total number of patients included	n=224
Median number of patients in study (range)	n=2 (1–34)
Mean age (years)	54.9 (38–77)
Type of MUS	n=184
RP	60%
TO	28%
SIS	4%
Non-synthetic	8%
Presenting symptoms	n=181
Irritative	65%
SUI recurrence	51%
Pain	46%
Obstructive	42%
rUTI	26%
Fistula	12%
Hematuria	4%
Mean time between initial MUS surgery and erosion	
Symptoms (months), n=45	17.8 (0–133)
Diagnostic (months) n=96	31.9 (1–180)
Mean followup after erosion management (months)	16 (1–144)

MUS: mid-urethral sling; RP: retropubic; rUTI: recurrent urinary tract infection: SIS: single-incision sling; SUI: stress urinary incontinence; TO: transobturator.

or electrode loop mesh resection. We believe this difference may be explained by the laser or electrical heat causing additional urethral tissues injury; however, due to the small number of patients, an appropriate statistical comparison was out of reach and thus, we were not able to confirm the superiority of one method over the other. These approaches can be used for partial and transfixing urethral erosions but logically, were not used in the presence of a urethrovaginal fistula. Thus, we recommend that endoscopic or direct transurethral resection may be used as a first-line option, regardless of the severity of the erosion, in the absence of a fistula.

In case of failure after transurethral mesh excision, observation, transurethral re-do, or transvaginal approaches were reported. Unfortunately, our review was not able to identify the optimal sequence because of the paucity of data; however, a recent review analyzing endoscopic and direct transurethral management of mesh erosion in the urinary tract reported that 27% of the patients required additional treatment for persistent erosion. The latter group has undergone a transurethral resection re-do and only 8.4% of them required subsequent procedures for erosion. Moreover, the final success rate varies from 92–98%, complications were exceptional, and the transurethral re-do was associated with a low 3% risk of fistula development.[61] Because of this high probability of success and the minimal surgical risk, we believe it may be reasonable to repeat endoscopic or transurethral resection on one occasion before aiming for more invasive management, such as transvaginal urethrotomy, if surrounding urethra seems healthy enough.

The transvaginal repair was the first technique described for the treatment of MUS urethral erosion,[30,52,62] and according to our review, is still the most used today. In our review, patients treated this way were more likely to have a urethrovaginal fistula at initial erosion presentation and multiple previous failed repair attempts. Both partial and complete removal of the vaginal portion of the mesh were described but we were not able to compare their respective outcomes; however, we observed that all failed erosion repairs were associated with a partial mesh excision and thus, we believe it seems preferable to aim for a complete MUS vaginal portion excision when a transvaginal approach is elected.

In our review, 79 patients underwent a flap interposition for transvaginal repairs. These flaps seem to be associated with a lower incidence of fistula occurrence after repairs (2.5%) than when no flaps were used (12%). Unfortunately, our review could not point out when the use of a flap was beneficial; however, it has been stated in previous urovaginal fistula series that flaps are strongly recommended when the quality of the tissue or blood supply is poor, when there is significant local inflammation, or when a tension-free defect closure is impossible.[63,64]

Dealing with non-synthetic PVS erosion is an interesting subject since, with the decline of synthetic MUS that we are experimenting with today, their use may increase. Few articles were available on urethral erosion management in such cases but they suggested that both simple incision and partial excision through a transurethral or transvaginal approach were associated with a high success rate. In addition to the limited number of patients included, the maximum followup time was only 27 months and thus, more extensive, and long-term data are needed.

Table 6. Management of non-synthetic sling erosion

	# (n=14)	Mean age (59.5 yrs)	Erosion type	Fistula	Mean erosion timing (7 mos)	Mesh excision extends	Flap interposition	Mean followup (15.7 mos)	Outcomes		Subsequent treatment
									Persistence of SUI 6/14 (43%)	Persistence of erosion 0/14 (0%)	
Golomb (2001)	1/1	46	Partial	No	7	TV division	No	12	0	0	None
Webster (2003)	1/1	73	Transfixing	No	0.5	TU partial	–	–	0	0	–
Clemens (2000)	6/6	–	–	Yes	13	TV partial (1), TV complete (5)	No	8	5	0	Non-syn. sling (2)
Amundsen (2003)	6/9	–	–	No	8	TV division	No	27	1	0	None

SUI: stress urinary incontinence; TU: transurethral; TV: transvaginal.

One observation that emanates from this review is the high rate of persistent (79%) or de novo (19%) SUI following MUS erosion repair, regardless of the management approach. Thus, informing the patient about this complication is mandatory. Our review could not clarify whether the implantation of an autologous sling at the time of erosion repair is useful and safe in preventing such a complication; however, previous experience with urethral diverticulum repair has demonstrated that autologous PVS placement at the time of repair is safe and is associated with an SUI resolution rate of more than 90%. Those slings were placed without tension overlapping the repaired region.[65,66] Twenty-two patients in our review had a PVS at the time of erosion repairs, with only one patient requiring a sling incision for obstructive symptoms and none experiencing incontinence. Therefore, we believe that if SUI is present, concomitant incontinence surgery with autologous tissues should be considered. That said, the optimal sling position in case of erosion has not been studied yet and strong recommendations cannot be made at this time. On the other hand, because of its higher risk of erosion or infection, synthetic material should not be used at that time.[67] Further studies are necessary to confirm the safety, optimal position, and efficacy of autologous PVS at the time of urethral erosion surgery.

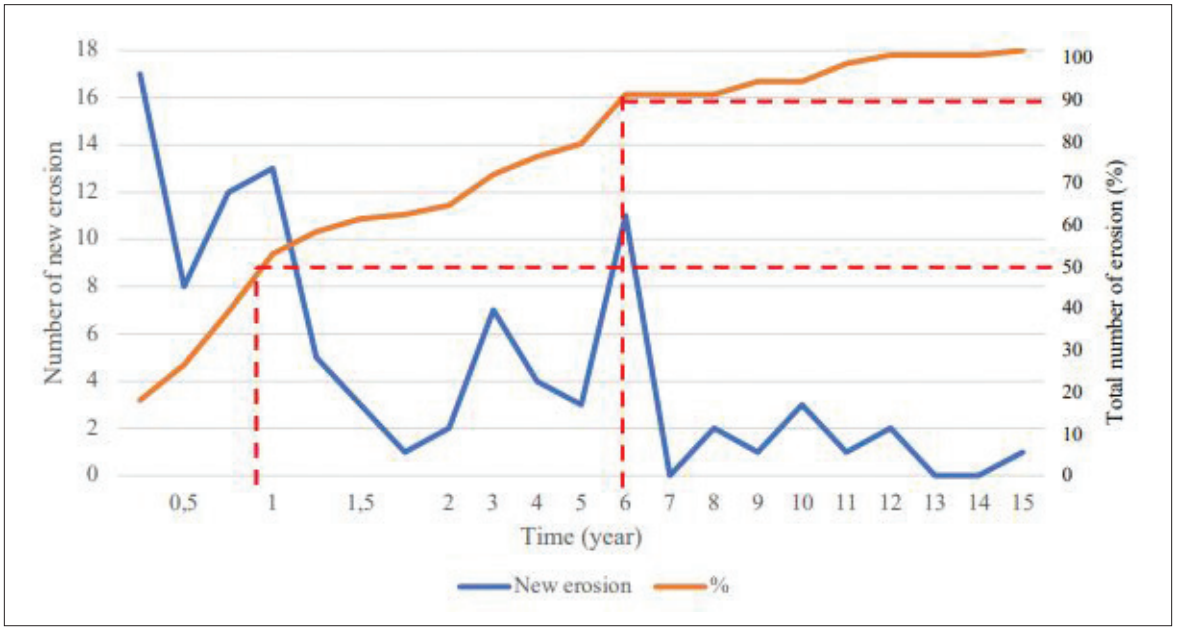

Figure 2. Timing from mid-urethral sling (MUS) insertion to erosion diagnosis.

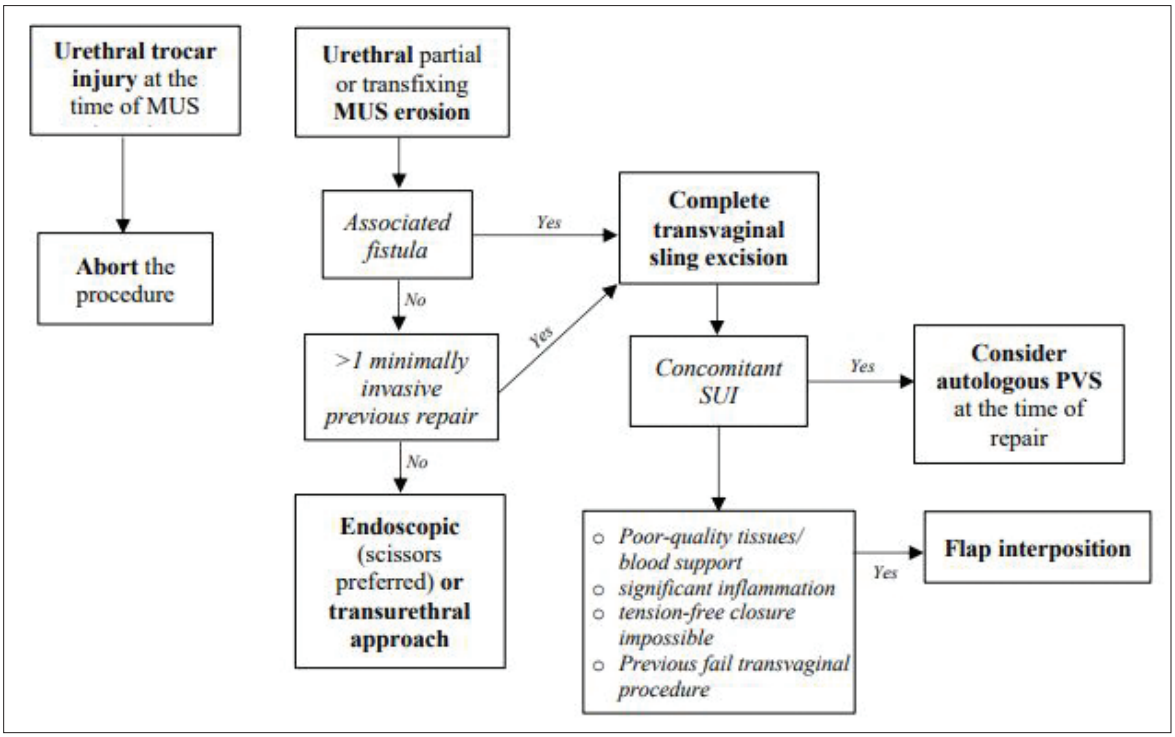

Figure 3. Suggested management algorithm. MUS: mid-urethral sling; PVS: pubovaginal sling; SUI: stress urinary incontinence.

Interestingly, we found that urethral erosion occurred in most patients within the first year after MUS insertion and that new diagnoses were rare after six years. This is consistent with the findings of Saidan et al, who reported an incidence peak in the first years.[68] Moreover, patients diagnosed within the first year frequently experience symptoms since initial surgery, suggesting that these early erosions may be due to unrecognized urethral trocar injury at the time of sling insertion. This underlines the fact that when a urethral trocar injury is identified during the initial MUS placement, the procedure should be aborted due to the high risk of erosion, as recommended in both the CUA and AUA guidelines.[59,60]

Limitations

Even though this study is, to our knowledge, the largest review on the management of sling-associated urethral erosion, it still has its limitations. Indeed, the quality of the studies included is weak, as only retrospective and case reports were found. Moreover, the small total number of patients included, in addition to the limited followup time, prevents us from drawing robust guidelines and conclusions on the optimal management algorithm. Nevertheless, this review provides general guidance that may help clinicians in their choice and sequence of treatment. A suggested management algorithm is shown in Figure 3.

CONCLUSIONS

Even though it is a rare event, several management options for urethral sling penetration have been described in the literature. Acceptable treatment includes endoscopic, transurethral, and transvaginal sling excision. Transvaginal sling resection with tissue interposing seems to carry the lowest risk of erosion recurrence. All types of treatment are associated with a high recurrence rate of SUI.

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