



Narrative review of male urethral sling for post-prostatectomy stress incontinence: sling type, patient selection, and clinical applications

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Abstract: Male stress urinary incontinence (SUI) following prostate treatment is a devastating complaint for many patients. While the artificial urinary sphincter is the gold standard treatment for male SUI, the urethral sling is also popular due to ease of placement, lack of mechanical complexity, and absence of manual dexterity requirement. A literature review was performed of male urethral sling articles spanning the last 20 years using the PubMed search engine. Clinical practice guidelines were also reviewed for comparison. Four categories of male urethral sling were evaluated: the transobturator AdVance and AdVance XP, the bone-anchored InVance, the quadratic Virtue, and the adjustable sling series. Well selected patients with mild to moderate urinary incontinence and no prior history of radiation experienced the highest success rates at long-term follow up. Patients with post-prostatectomy climacturia also reported improvement in leakage after sling. Concurrent penile prosthesis and sling techniques were reviewed, with favorable short-term outcomes demonstrated. Male urethral sling is a user-friendly surgical procedure with durable long-term outcomes in carefully selected men with mild stress urinary incontinence. Multiple sling types are available with varying degrees of efficacy and complication rates. Longer follow-up and larger cohort sizes are needed for treatment of newer indications such as climacturia as well as techniques involving dual placement of sling and penile prosthesis.

Keywords: Male urethral sling; climacturia; stress incontinence; Mini Jupette

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Introduction

Rationale/background

Iatrogenic male stress urinary incontinence (SUI) is a distressing phenomenon occurring most commonly after treatment of the prostate gland (1,2). Radiation therapy, open and robotic approaches to prostatectomy, as well as endoscopic procedures such as transurethral resection of the prostate (TURP) and holmium laser enucleation of the prostate (HoLEP) have all been implicated at post-

procedure incidences ranging from <0.5% to 21.3% at one year (3-6).

The surgical treatment of SUI has advanced considerably since the first artificial inflatable urethral cuff was invented in 1947 by Dr. Foley (7). The AMS 800 (AMS, Minnetonka, Minnesota) artificial urinary sphincter (AUS) is the most commonly used version of the gold standard treatment for male SUI today (8,9). Regardless, surgical innovators have continued to search for less invasive and more durable alternatives to this device over the decades.

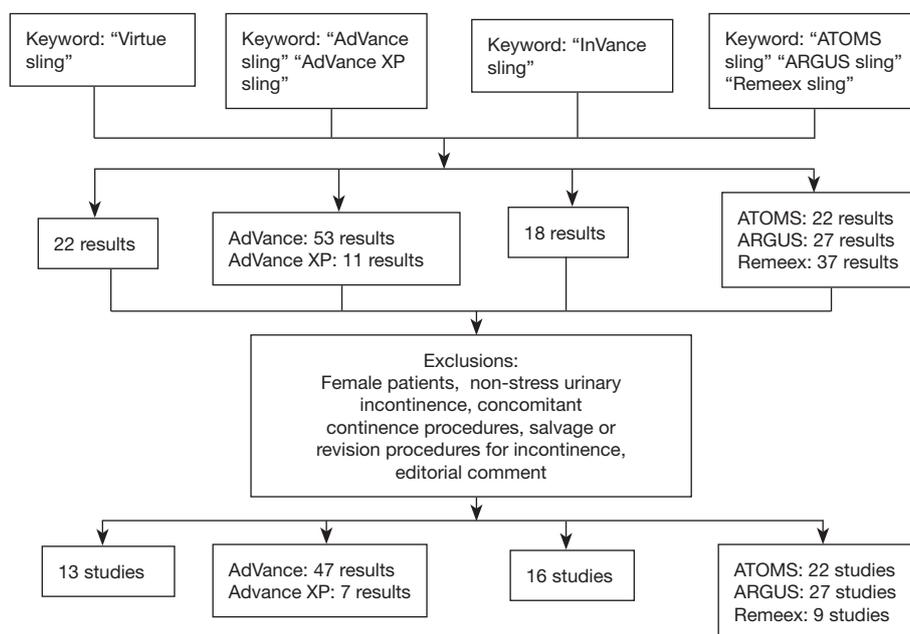


Figure 1 Flowchart of literature search.

The male urethral sling was first developed in the 1970s by American urologists John L. Berry and Joseph Kaufman who described placement of acrylic mesh ventral to the bulbar urethra (10). Early on, complications such as urinary fistulas and urethral erosions prevented the male sling from gaining widespread popularity but they developed a following in the 1990s as a management option for men with mild SUI, defined as 1–3 pads per day (PPD) (11,12). Kumar *et al.* reported in 2009 that when given a choice between the male sling versus the AUS, the majority of patients preferred the sling due to the lack of post-operative waiting period to achieve benefit, no need for device manipulation to urinate, and no risk of mechanical failure (13). National operative trends, as indicated by Medicare database analyses as well as case logs of practicing urologists, have shown increasing sling procedures being performed over time (14,15). This being said, Liu *et al.* showed that AUS was still the most commonly performed male incontinence procedure during the period studied, especially for academically affiliated urologists (14).

Objectives

With the aging population and rise in treatment for age related conditions such as benign prostatic hyperplasia

(BPH) and prostate cancer, it is crucial for urologists to understand the unique benefits and limitations of each surgical treatment option for iatrogenic male SUI. The majority of incontinence procedures are done by a small percentage of surgeons with most urologists performing these cases infrequently (14). Therefore the current paper seeks to review the available literature on male urethral slings including a discussion of indications, patient selection, sling types, outcomes, and areas for future research. We present the following article in accordance with the Narrative Review Reporting Checklist (available at: <http://dx.doi.org/10.21037/tau-20-1459>).

Materials and methods

Data source

A literature review to identify peer-reviewed, evidence-based articles published in the last 20 years (2000 to present) was conducted using the search engine PubMed (Figure 1). A variety of key words were utilized and the references of each identified article were thoroughly reviewed. Furthermore, clinical practice guidelines from the following societies were reviewed: American Urological Association (AUA), Canadian Urological Association (CAU), and European Association of Urology (EAU).

Article selection

Preference in article evaluation, in descending order, was as follows: randomized control trials, society guidelines, multicenter series, single institution/single surgeon series and review articles. Exclusion criteria included articles reporting: female patients, concomitant procedures known to affect urinary continence (injection of bulking agents, bladder neck repair etc) and urethral sling as a secondary or salvage procedure following failed primary incontinence procedure.

Outcomes of interest

The primary outcome evaluated was urinary continence. As definitions, evaluations or measuring systems for the degree of pre and post intervention urinary incontinence varied throughout the literature, all data reported herein utilizes the definitions specified in each individual article. Secondary outcomes evaluated, when reported, include: patient satisfaction, comparison of pre and post intervention standardized questionnaires, surgical complications, failure rates, re-intervention rates, erosion/explanation rates and median follow-up time.

Narrative

Four categories of male urethral sling are described: the transobturator sling (AdVance and Advance XP), the bone-anchored sling (InVance), the quadratic sling (Virtue) and the adjustable sling (ATOMS, ARGUS and Remeex). The primary outcome of continence was most commonly assessed using number of PPD, though some studies also used pad weights. *Table 1* provides an overview of the outcomes for slings which are commercially available in the United States; namely the Advance XP and Virtue slings. Articles with at least 20 patients and 6 months of follow up were chosen for representation in the table.

The AdVance sling

The Advance (Boston Scientific, formerly AMS, Minnetonka, MN) is a transobturator sling that works by repositioning the bulbar urethra proximally and supporting the distal membranous urethra without causing obstruction (27). Of note, the AdVance has now been completely replaced by the AdVance XP and is no longer available to purchase.

The objective success rate is defined in most studies by the 24-hour pad test as 0-1 PPD. This is as high as 73% with the Advance Sling reported by Soljanik *et al.* in a study of 189 patients at mean 20.8 months of follow up (28). Using more stringent criteria of 0 PPD, Cornu *et al.* reported a 63% success rate in 136 patients at 21 months (29). Finally, using the most stringent objective definition of less than 2 grams of urine in 24 hours, Cornel *et al.* reported success in only 9% of 36 patients at 12 months (30).

Predictors of worse postoperative continence were history of prostate radiation and severe baseline incontinence (31-35). Chung *et al.* noted that it is important to ensure a smooth extubation from anesthesia to avoid loosening of the sling with coughing (36). The overall complication rate was 12.3% in a systematic review by Crivellaro *et al.* (37). The most commonly reported complication was temporary urinary retention in 5% to 21.3% of patients, though Cornu *et al.* reported no retention in their large series and reports of permanent retention were rare (38-40). Bauer *et al.* also noted that severe complications were uncommon, as was explanation of the sling which occurred in 1% of patients (41).

The AdVance XP sling

The AdVance XP (Boston Scientific, formerly AMS, Minnetonka, MN) is a transobturator sling similar to the AdVance with the addition of Chevron tissue-anchoring mechanism to prevent sling migration, 2 absorbable sutures with knots and strengthen heat-sealed mesh edges, a Tyvek liner within plastic sheath, and longer mesh arms for easier use in larger patients (16). The AdVance XP has now entirely replaced the AdVance.

Bauer *et al.* reported that 64.9% of 114 patients were cured at 3 months using the AdVance XP sling, while 66% of 40 patients remained cured at 36 months (17). High long-term positive outcome rates were also noted in a study of 115 patients, where 71.7% of the patients were cured, while 15.0% had improved symptoms (18). In contrast, another study of 41 patients reports only 46.3% and 29.3% of patients were respectively reported as cured and improved at 36 months (42).

Significant differences in outcomes or complication rates were not noted in papers directly comparing Advance and Advance XP slings. Mean operative time, outcomes, and most complication rates were comparable at a mean follow-up time of 34.7 months among 79 AdVanceXP and 47 Advance patients in one study (43). The only significant

Table 1 Comparison of success rates in commercially available male urethral slings in the United States for treatment of stress urinary incontinence

Sling	Reference #	Patients, N	Preop 24h incontinence measurement	Etiology	Definition of cure	Cure rate (%)	Follow up (m)
AdVance XP	(16)*	27	200 g	RP or TURP	0 PPD	80	26
	(17)	115	272 g	RP	0 PPD or <5 g 24 h pad weight	66	36
	(18)	115	272 g	RP	0 PPD or <5 g 24 h pad weight	71.7	48
	(19)	41	3 pads	RP	0 PPD	65.9	24.7
	(20)*	70	93 g	RP	0 PPD	71	49
	(21)*	158	2.8 pads	RP or TURP	0–1 PPD	82.3	42
Virtue	(22)	98	203 g (unfixed), 147 g (fixed)	RP	>50% decrease in 24 h pad weight	41.9 (unfixed), 79.2 (fixed)	12
	(23)	35	54.3% mild (≤ 100 g), 45.7% mod/severe (>101 g)	RP, TURP or radiation	0 PPD or 1 security pad	84% of mild, 44% of moderate/severe	11
	(24)	29	128 g	RP	0 PPD	58.6	36
	(25)	32	3 pads	RP, radiation, PVP	0–1 PPD	32	55
	(26)	48	129 g	RP	0 PPD	43	22

* , no statistical breakdown between AdVance and AdVance XP continence outcomes. RP, radical prostatectomy; TURP, transurethral resection of the prostate; PVP, photovaporization of the prostate.

difference found was in urinary retention, with 3.7% and 10.3% of patients in the AdVance and AdvanceXP groups respectively affected (43). The lack of significant differences between the slings was noted in other papers (19,44). Collado *et al.* reported no significant difference between the slings but noted that preoperative 24 hour pad weight was significantly related to postoperative continence outcome (20).

The InVance Sling

The InVance Sling (American Medical Systems, Minnetonka, MN, USA) is bone-anchored sling attached to the ischiopubic rami with a silicon-coater polyester sling positioned under the bulbar urethra (45). Note that due to complication rate and risk of bone infection the InVance sling is no longer on the market, therefore it is mentioned for historical context only.

A study of 106 patients, 75.5% and 5.7% of patients reported being dry or improved at three months, respectively (46). The rate of little or not improved at 3 months was 18.8% and increased to 24.5% at one year (46).

Spie *et al.* also recorded 106 cases stratified into previous radiotherapy (n=24) and a non-radiotherapy control group (n=82) showing that while 3 month results were similar, at 12 months continence declined in the radiotherapy group to 53.6% and remained 62.5% for the control group (47).

When examining predictors of success, Carmel *et al.* did not find significant differences in outcomes between mild (preoperative 2–3 PPD) and severe (preoperative >3 PPD) stress urinary incontinence groups (48). Other studies have found deteriorating success rates correlating with more severe preoperative conditions (46,49,50). Three preoperative parameters were noted by Lanoe *et al.* to be significantly associated with sling failure: severe urinary incontinence, urodynamic detrusor instability, and incontinence due to biotherapy, including external radiation (51). Regarding complications, explanting the sling due to bone infection was needed in as many as 17% of cases (51). Other studies noted a need to reposition the sling, transient perineal and scrotal pain or numbness, de novo urinary irritative disorders and acute urinary retention requiring catheterization (48). An increased rate of

complications was correlated with increased operation time and patients' age (46,49,51,52).

One study compared participants stratified into AdVance and InVance Sling groups, finding that 79.1% in the Advance group versus 77.4% in the InVance group reported being cured (0 PPD) although almost 30% of the AdVance group and 16% of the InVance cures deteriorated at 5 year follow up (53). The InVance group had a higher percentage of complications of 22.2% compared to 16.8% in the Advance group (53).

The Virtue Quadratic Sling

The Virtue (Coloplast Humlebaek, Denmark) quadratic sling is a transobturator sling with a 4-armed large pore mesh providing proximal urethral relocation using a TO component together with a prepubic component providing perineal urethral compression (22).

In a study of 29 patients using a criterion of success of patients being dry (0 PPD or 1 PPD for precaution), ≥ 1 PPD, or an at least 50% decrease in pad usage, a success rate of 83% was reported at a mean follow-up of 11 months (23). Nineteen (54.3%) and 16 (45.7%) patients in this study were characterized preoperatively with mild (≤ 2 protections and/or < 100 mL/24 h) or moderate (3–4 protections and/or 101–200 mL/24 h) /severe (> 4 protections and/or > 200 mL/24 h) incontinence, respectively (23). Importantly, the high success rate differed by preoperative conditions, with the mild group having an 84% success rate and the severe group with a 43% success rate (23).

A second study found 100% of patients (n=29) used at most 1 PPD and were satisfied with the procedure at 12 months follow-up (24). In contrast to these two studies' positive results, in a long-term study (median follow-up of 55 months) with failure defined as no change in postoperative pad use, failure to reduce leakage below 2 PPD, need for an artificial genitourinary sphincter, and/or need for sling explant, there was a reported failure rate of 68% (n=21) (25). In this study, only 32% of patients (n=10) were considered successful at the end of the longer follow-up period (25).

Reported surgery complications included scrotal pain, acute urinary retention and infections requiring explanting of the sling (24–26). Previous radiotherapy and more severe preoperative incontinence were associated with higher failure rates (23). McCall *et al.* and Hogewoning *et al.* both cautioned that longer monitoring and reporting of Virtue Quadratic outcomes is needed (25,54).

The Adjustable Sling

Three popular adjustable slings are the Argus classic and ArgusT (Promedon, Argentina), ATOMS (A.M.I., Austria), and Remeex (Neomedic International, Spain). These models provide pressure on the bulbar and membranous urethra to improve continence (55). At the time of this article, these slings are not yet approved by the United States Food & Drug Administration for use in the United States.

In the largest study of 215 ATOMS patients, Angulo *et al.* achieved a success rate of 80.5% (96.2% and 75.3% in the mild and moderate-severe preoperative group, respectively) (56). They reported that 121 patients (56.3%) did not use any pads and 52 patients (24.2%) used a security pad (less than 10 mL of urine loss) (56). At mean 24.3 months follow-up, the dry rate decreased to 73%, while 3.25% (n=7) patients required the device's explantation (56). Worse preoperative incontinence and radiotherapy were found to be predictors of decreased success (56). Doiron *et al.* also reported a high continence rate of 80.0% with improvement in 87.8% cases in a 60-patient study at a median follow-up of 9.0 months (57). Seventy percent of these patients underwent a mean of 2.4 (SD 2.7) adjustments (57).

In looking at the Argus sling, Cotugno *et al.* reported a short-term study at 3 months post-operation that 70% (21 patients) reached total continence defined as using less than one PPD (58). The remaining 30% (9 patients) were noted as having a clinically significant improvement (58). Looking at differences in outcome due to preoperative conditions, Bochove-Overgaauw *et al.* reported differences of 92% (12 of 13), 67% (29 of 43), and 67% (26 of 39) in the mild, moderate, and severe incontinence group (59). A complicating factor for the Argus' high success rate is the reported decline in continence over time. In a study of 74 Argus classic patients and 32 ArgusT patients, Loertzer *et al.* reported a long-term dry rate at a median follow-up of 44.0 months of only 33.0% and 11.8%, respectively (60). They did not confirm the ArgusT model as an independent predictor of procedure success but did note that inguinal pain and explanation rates were higher for the ArgusT sling (43). When looking at complications, Cerniauskiene *et al.* reported that 54% (n=22) experienced 31 complications, including intra-operative bladder perforation and postoperative like acute urinary retention and infection (61). Kretschmer *et al.* compared complication rates in 127 adjustable sling patients (95 Argus classic and 32 Argus T) to 155 artificial

Table 2 Factors associated with improved male urethral sling outcomes

Patient factors to consider
≤2 pads per day
MSIGS score of 0–2
No history of radiation or prior urethral surgery
Pad weight <200 g/day
Voluntary coaptation of external sphincter
Perineal repositioning test
Adequate detrusor contractility
Lack of detrusor overactivity
Low post-void residual

urinary sphincter (AUS) patients (62). The adjustable slings were noted to have significantly increased intraoperative complication rates (15.9% to 4.2%, $P=0.003$); however, explantation rates were significantly lower for the adjustable slings than the AUS devices (9.2% vs. 21.5%, $P=0.020$) (62).

The last major adjustable sling type is the Remeex device. Sousa-Escandon *et al.* reported in a study of 55 patients using the Remeex sling that, after additional adjustments at a mean follow-up of 32 months, that 45% ($n=25$) of patients used no pads, 15% ($n=8$) used a security pad, 19.6% ($n=10$) had improvement in symptoms, and 15.7% ($n=8$) remained unchanged (63). They reported urethral erosion in 2 (4%) cases and 5 (9%) cases of intraoperative bladder perforations (63). A more recent study reported slightly worse outcome rates in 25 patients of whom 36% ($n=9$) patients were cured but 28% ($n=7$) did not improve at a mean follow up of 31 months (64).

Summary

Work-up/Identification of the Ideal Sling Candidate

Multiple studies have attempted to characterize the ideal sling candidate with the highest chance of post-treatment success. Morey *et al.* developed a Male Stress Incontinence Grading Scale (MSIGS) in 2016 to assess the severity of post-prostatectomy incontinence (65). Per the MSIGS protocol, patients wait at least 60 minutes after their last void, and then forcefully cough 4 times while in the standing position. The degree of incontinence is then assessed by 2 examiners as follows: Grade 0 leakage not demonstrated on exam, Grade 1 delayed drops, Grade 2 early drops,

Grade 3 delayed stream, and Grade 4 is early stream. In a review of AdVance sling placement spanning 9 years, Viers *et al.* found that patients without radiation history, MSIGS 0–2, and preoperative use of 2 or less PPD enjoyed an 81% success rate, defined as 1 PPD or less (66). Shakir *et al.* then used the MSIGS to rapidly evaluate first-time male sling candidates with history and clinical exam alone, finding that the addition of MSIGS to a predictive nomogram increased the prognostic value significantly (67).

Sturm *et al.* also explored the concept of an “ideal” sling candidate in a retrospective study, defining “ideal” as those patients with mild to moderate incontinence, good sphincter control and detrusor function, no radiation history and low post-void residual (68). Cure as defined by 0 PPD was achieved by 50% of ideal patients versus only 22% of non-ideal patients (68). Other studies have also found degree of preoperative incontinence to be highly predictive of sling success (16,21,69). One should be aware that the definition of incontinence has been debated by many. While Nitti *et al.* found excellent concordance in their prospective analysis of patient perception of pad use compared to actual number and weight of pads used, other studies found that reported PPD did not correlate well with 24 hour pad weight (70–72). Surgeons may therefore consider the standing cough test, which does correlate strongly with 24 hour pad weight and may be a more useful metric for patient selection (73).

To this end, national and international guidelines propose that male slings be used only for mild to moderate incontinence, as men with severe incontinence would have greater benefit from an AUS (74,75). The guidelines also advise that a history of radiation, or prior surgery for urethral stricture are predictors of negative outcomes (75). This is likely secondary to fixation of the urethra which limits proximal relocation as well as healing.

It is important for surgeons to be as objective as possible about patient selection for male urethral sling and avoid being overly swayed by patient preference or personal comfort with sling technique. In fact, 25% of patients would even choose the sling against surgeon recommendations due to their motivation to avoid a mechanical device (13). *Table 2* highlights preoperative patient factors that may streamline the selection of candidates who are most likely to benefit from male urethral sling. We recommend office cystoscopy prior to surgical intervention for incontinence to rule out urethral stricture or bladder pathology, and characterize urethral health and degree of voluntary membranous urethral coaptation (68). The perineal repositioning

test can also be performed which Bauer *et al.* found was significantly correlated with postoperative cure rate in a prospective study (76). This reflects the ability of the male sling to mechanically reposition the proximal bulbar urethra and reinforce a functioning external urinary sphincter complex—both critical components to sling success.

Urodynamic evaluation is of variable importance in the evaluation of male stress urinary incontinence unless the diagnosis is in question. Patients with underactive bladders are thought to be best served by AUS, as adequate detrusor contractility is needed to urinate against the compressive force of a sling (77). However as Han *et al.* have shown, patients with underactive detrusor contractility can still undergo sling placement without significant increases in urinary retention rate (78). Theoretically, patients who Valsalva void may also be at higher risk of loosening the sling postoperatively and may need to be counseled accordingly (36). On the other end of the spectrum, overactive bladder can develop in almost half of post-prostatectomy patients and may need to be treated; however, it alone does not preclude men from undergoing sling for stress incontinence (79).

With regards to timing of anti-incontinence procedures, studies suggest that conservative management should be used for the first year after surgery to allow for patients to recover to their fullest extent (80). Matsushita *et al.* found that membranous urethral length on preoperative prostate MRI was predictive of continence recovery at 6 and 12 months, which is helpful for patient counseling and avoidance of overtreatment.

Sling for stress incontinence

While no one sling type is currently recommended over another by the incontinence guidelines, certain situations may favor a particular approach. For example, in patients with detrusor underactivity, the transobturator sling's non-compressive mechanism of action may result in lower rates of postoperative retention (80).

The quadratic sling may improve, but not cure, more severe levels post-prostatectomy leakage using a novel fixation technique by Comiter *et al.* (22,81). Their study design incorporated intraoperative measurement of retrograde leak point pressure of 60 cmH₂O to guide tensioning of the sling's transobturator and prepubic arms (22). Eighty percent of patients reported >50% decrease in 24 hour pad weight with no difference seen based on preoperative incontinence level. The

transobturator and bone-anchored slings, by comparison, have not been modified for use in men with severe urinary leakage (74).

In the event there is persistence or recurrence of SUI after quadratic sling placement, an artificial urinary sphincter can be effectively placed by division of the mesh component and exposure of underlying bulbar urethra (82). Others have reported revising the quadratic sling alone through a series of imbricating tensioning sutures with good results (81). In general, sling success is highly dependent upon patient selectivity. As such, patients with moderate to severe incontinence, history of radiation, or requiring a salvage procedure after failed urethral sling, implantation of an AUS is preferable.

Sling for climacturia

Climacturia is a bothersome condition in which patients report incontinence with orgasm. While previously underreported, it is now thought to be prevalent in 23% to 40% of men post radical prostatectomy (83,84). A retrospective review by Nolan *et al.* found that in men with general stress incontinence plus climacturia, AdVance slings improved both subjective frequency of climacturia as well as associated bother (85). Christine and Bella placed AdVance slings in 46 men with climacturia, all of whom reported resolution and 86% of whom also reported complete resolution of stress incontinence (86). Jain *et al.* evaluated 11 men who underwent surgery for SUI and climacturia; 75% of those who underwent AUS and 57% of those who underwent sling reported marked improvement in climacturia.

Erectile dysfunction with concurrent treatment of incontinence (Mini Jupette)

For post radical prostatectomy patients with both erectile dysfunction and mild stress urinary incontinence, R. Andrienne described the placement of a “mini Jupette” mid urethral sling—French for mini-skirt—at the same time as an inflatable penile prosthesis (IPP) (87). A polypropylene graft is sutured to the medial aspect of the corporotomies such that when the IPP cylinders inflate, the sling compresses the urethra. Yafi *et al.* performed a prospective multicenter investigation of this technique, finding that almost 80% of patients experienced resolution of climacturia with a postoperative complication rate of 7.9%, no higher than for IPP placement alone (88). Tutoplast

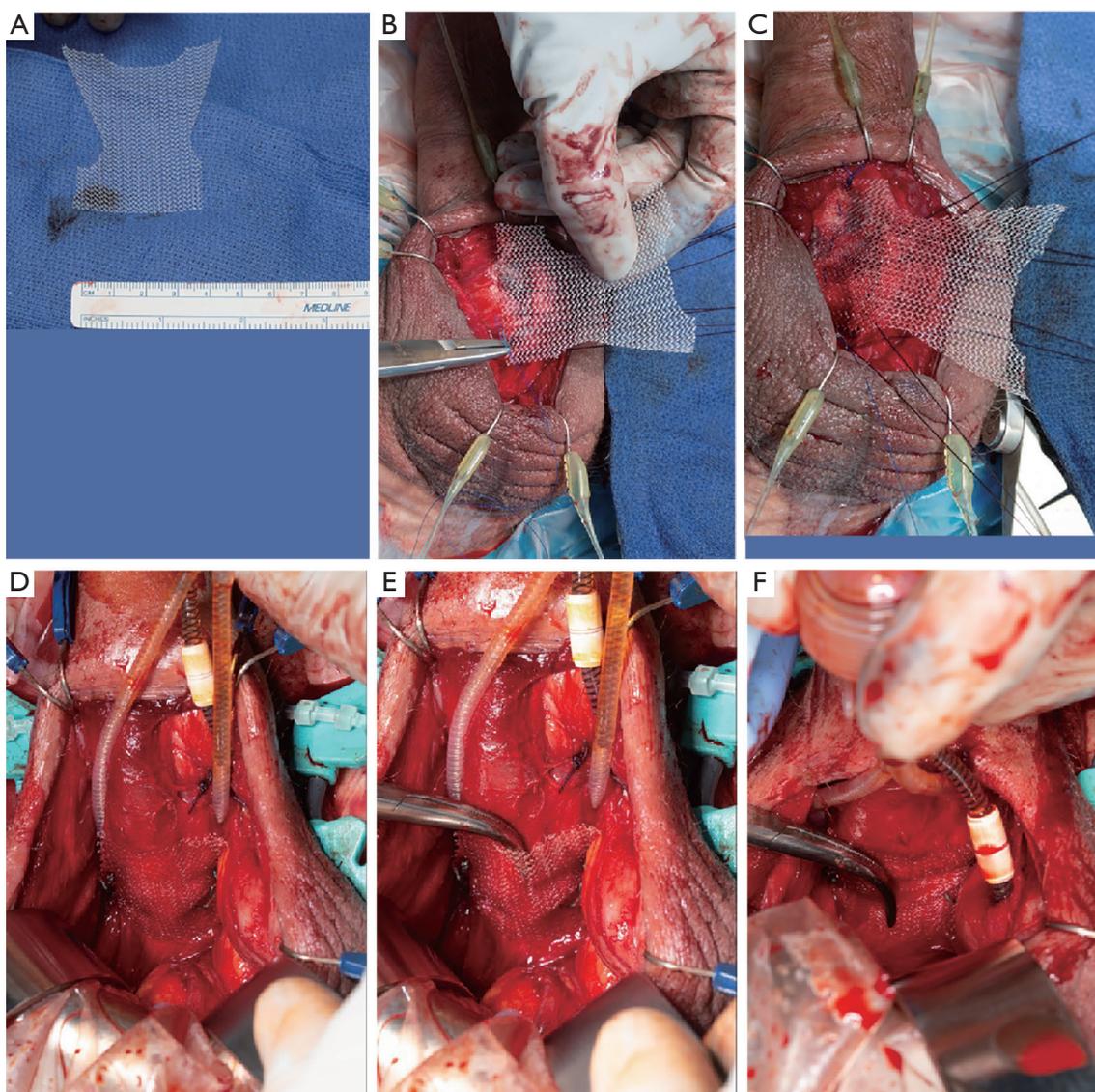


Figure 2 The Mayo Clinic modified Mini Jupette technique. Ethibond stay sutures are preplaced in four quadrants, directly inferior to the IPP corporotomy sites. IPP is placed in standard fashion and corporotomies are closed. (A) Four limbs are cut off a Coloplast Virtue Quadratic sling. (B) Preplaced Ethibond sutures being passed through mesh. (C) Ethibond sutures passed through one side of sling. (D) Mini-Jupette mesh tied down in place with IPP deflated. (E) Right angle can be accommodated when IPP deflated. (F) Right angle cannot be accommodated with maximal IPP inflation.

bovine pericardium and autologous fascia have also been used as alternate graft materials with success rates over 80% (89,90).

Since the original technique, other surgeons have described modifications such as the Mayo technique by Dr. Tobias Kohler in which a Virtue sling with the limbs cut off is affixed over the proximal bulbar urethra, such that a right angle can slide under the sling when the IPP is deflated

(Figure 2A,B,C,D,E,F) (89). Valenzuela *et al.* similarly used Virtue sling mesh in 36 patients, observing resolution of climacturia in 93% (91).

Dual implantation of IPP and sling is not overly time consuming with a total procedural time equivalent to each separate procedure; and one study showed cost savings of approximately \$9,000 (92). Infection rate has been reported at 1.2% by some authors, which is comparable with IPP

placement alone (93). Concomitant implantation of AUS and IPP has also been described, with placement of both reservoirs within either the space of Retzius or a high submuscular tunnel (94). However, as evidenced by Morey *et al.*, the combination of IPP and AUS may be associated with greater risk of urethral erosion due to compression of the urethral cuff by the rigid rear-tip extenders (95). In this population of men, selective use of a transobturator or quadratic sling in combination with IPP may serve as a viable alternative to address male SUI and potentially reduce the risk of long-term urethral injury.

Limitations

There are several limitations to this review worthy of discussion. First, this review article is limited by the quality of currently published material on this topic. Second, aggregate statistical analysis or direct comparison between articles is challenged by the lack of standardized reporting metrics for pre and post intervention incontinence. Within these limitations, this is one of the most comprehensive reviews on the male urethral sling spanning two decades of published literature. Studies with longer follow-up to address sling durability and larger cohorts to evaluate efficacy of newer techniques such as the Mini-Jupette are needed.

Conclusions

While post-prostatectomy SUI is the primary indication for male urethral sling, bothersome climacturia is also improved. The ideal sling candidate has mild to moderate incontinence, no history of radiation, and no evidence of bladder outlet obstruction. In this large, 20-year contemporary review of male urethral sling, we explore the types of male slings currently available, continence outcomes, and complication rates as reported by high-volume urologists. Future studies with larger patient cohorts and long-term outcomes are needed for promising new techniques such as concomitant placement of sling and penile prosthesis.

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