# *Male urinary incontinence after prostate disease treatment*

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DAS AK, KUCHEROV V, GLICK L, CHUNG P. Male urinary incontinence after prostate disease treatment. *Can J Urol* 2020;27(Suppl 3):36-43.

***Introduction:*** *Incontinence after prostate treatment (IPT) is an important and common problem for men and can lead to decreased quality of life. The proper evaluation and management of IPT requires both knowledge of the mechanisms for its development and of multiple evolving therapy types.*
***Materials and methods:*** *An update is provided on the evaluation and management for IPT. The underlying pathophysiology of the contributing conditions is explored along with the appropriate assessment prior to therapy. Surgical techniques including the artificial urinary sphincter (AUS) and male urethral sling are detailed specifically and compared.*
***Results:*** *IPT can result from radical prostatectomy (RP), prostate radiation, and surgery for benign prostatic hyperplasia. All of these may increase the risk for stress urinary incontinence (SUI), urge urinary incontinence (UUI), or mixed incontinence. SUI after RP remains the largest component of IPT. Perioperative pelvic floor muscle therapy and advances in surgical technique have helped to prevent and treat post-RP SUI. The AUS and male urethral sling are both excellent surgical options for SUI with the AUS being currently indicated for a broader set of patients. Predominant UUI should be treated in a stepwise manner based upon guidelines for overactive bladder.*
***Conclusions:*** *Evaluation of men with IPT should include determining components of SUI and UUI as these will direct medical and surgical therapy. While advances in surgical technique and technology have reduced prevalence of SUI after RP, many men still require treatment. Surgical treatments with AUS and male urethral sling provide excellent outcomes in well selected patients.*

**Key Words:** male incontinence, artificial urinary sphincter, male urethral sling

## Introduction

Urinary incontinence (UI) of all kinds increases the risk for anxiety and depression and is associated with lower healthcare related quality of life.[1] Reasons for UI are many-fold and particular attention must be paid to those that develop in the setting of treatment of other conditions. Such is the case for men who develop UI after surgical treatment for prostate cancer, from prostate radiation therapy (RT), and from surgery for benign prostatic hyperplasia (BPH). These types of incontinence as a group are termed incontinence after prostate treatment (IPT).[2]

IPT as a definition is inclusive of all types of UI including stress urinary incontinence (SUI), urge urinary incontinence (UUI), and mixed incontinence. SUI after radical prostatectomy (RP) is the most common and significant component. Men with prostate cancer are at a 4-fold increased risk for UI after RP when compared to watchful waiting.[3] Recent data suggest an average long term SUI rate after robot-assisted laparoscopic prostatectomy (RALP) of 8%-16% with variability based upon SUI definition, surgical technique, and skill level.[4,5] Pelvic floor muscle therapy (PFMT) in the perioperative setting and advances in RP surgical techniques have been shown to improve continence rates over time.[4,6] However, many men still develop symptoms bothersome-enough to seek intervention.

In this paper we provide a review and update of the evaluation and management for IPT. The underlying pathophysiology of the components of IPT is explored in addition to preventive measures (surgical and non-surgical) that have been popularized. Surgical therapy for male SUI is highlighted including the artificial urinary sphincter (AUS) and male urethral sling.

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## Etiology of IPT

### *Radical prostatectomy*

UI after RP is largely SUI however UUI may develop as well. SUI following RP is thought to result from several possible anatomic and nerve-related changes that occur from surgery. Rhabdosphincter incompetence alone has been found to be the sole cause of SUI after RP in 40%-92% of cases.[7] Given, however, that a large fraction of men recover continence by 6-12° months postop, it is thought that the insult is likely to the nerves and supporting tissue of the sphincter rather than direct sphincter damage per se. Studies have shown that preservation of membranous urethral length (MUL) > 12 mm is associated with increased continence following RP as well.[8]

UUI related to detrusor overactivity (DO) has been found to develop after RP as well. In a study by Groutz et al, post-RP DO was found in up to 34% of men. However for only about 7% of men was it the sole cause of UI.[9] A review by Thirucheivam et al of men with UI after RP who underwent urodynamic assessment found a more variable rate of overactivity between 2%-63%.[10] Overall, men with UI after RP should be evaluated for both SUI and UUI and treatment decisions based upon the relative components of each.

## Radiation therapy

RT to the prostate has long been known to have deleterious effects on the bladder and rectum, potentially leading to long term tissue damage and dysfunction. Pathologically, DNA-damage induced by RT can lead to long term inflammation, endarteritis, urothelial proliferation, collagen deposition, and fibroblast infiltration.[11] In the bladder, these inflammatory changes can lead to a nociceptive response that may manifest as DO.[12] Hoffman et al found that men who received pelvic RT for prostate cancer (with or without prior RP) had a higher rate of DO that those who did not get radiation (70% versus 38%, respectively) and had lower maximum cystometric capacity (253 mL versus 307 mL, respectively).[13] UI after prostate RT in the absence of surgical prostate therapy should raise the suspicion for DO which should be the initial focus of investigation.

## Surgery for BPH

Surgical removal of the obstructive prostatic adenoma in BPH can be associated with the development of other lower urinary tract symptoms including UI. Rassweiler et al found that after transurethral resection of the prostate, between 30%-40% of men can experience transient SUI, which drops down to < 0.5% over long term follow up.[14] Studies of the holmium laser enucleation of the prostate (HoLEP) have also shown postoperative UI; Cho et al reported a de novo SUI and UUI rate of ~10% each after HoLEP which fell to about 1% each at 12 months.[15] These men need careful evaluation to assess all the possible types of UI that may be present.

## Prevention of IPT

Preventative measures for IPT have principally involved increased knowledge of PFMT and refinement of RP techniques. The 2019 AUA/SUFU guidelines recommend that PFMT may be offered in the pre-RP setting and should be offered after surgery. Recent data suggest a possible increased value for pre-surgical PMFT. In a randomized trial by Milios et al, men planning RP randomized to intensive PMFT (120 contractions per day) versus conventional PMFT (30 contractions per day) starting 5-weeks preop experienced a faster return to continence and less severe leakage on 24-hour pad weight test.[16] This more intensive regimen is promising and deserves future study.

Techniques in RP have advanced significantly and have led to increased continence rates postoperatively. Sridhar et al reviewed surgical factors associated with increased postoperative continence which included bladder neck preservation, neurovascular bundle preservation, athermal division of the dorsal venous complex, preservation of ancillary anatomic support to the rhabdosphincter, preservation of MUL, and anatomic anterior/posterior reconstruction.[17] A recent review by Phuken et al of the Retzius-sparing technique in RALP showed that it was associated with improved continence rates and short time to continence recovery compared to standard RALP.[18]

## Patient evaluation

Office evaluation of men with IPT should begin with the relevant history and physical examination. Multiple questionnaire tools exist to help distinguish the types of UI men may experience. The International Consultation on Incontinence Questionnaire - Urinary Incontinence Short Form (ICIQ-UI SF) and the Michigan Incontinence Symptom Index (M-ISI), Tables 1 and 2, respectively, are brief tools designed to assess precipitating leakage events and symptoms.[19,20] An additional quasi-objective evaluation tool is the bladder diary for tracking fluid intake and leakage/symptom timing. Pad use including type, frequency, and level of dampness should also be assessed to better roughly define the quantity of leakage experienced.

**Please consider the following questions as they apply over the past four weeks**

| | | |
|---|---|---|
| How often do you leak urine? (check one box) | never | ☐ 0 |
| | about once a week or less | ☐ 1 |
| | two or three times a week | ☐ 2 |
| | about once a day | ☐ 3 |
| | several times a day | ☐ 4 |
| | all the time | ☐ 5 |
| How much urine do you usually leak? (check one box) | none | ☐ 0 |
| | a small amount | ☐ 2 |
| | a moderate amount | ☐ 4 |
| | a large amount | ☐ 6 |
| Overall, how much does leaking interfere with everyday life? | 0 1 2 3 4 5 6 7 8 9 10 | |
| | none at all | a great deal |
| | **ICIQ score: sum above =** | ☐ ☐ |
| When does urine leak? (check all that apply) | never - urine does not leak | ☐ |
| | leaks before you can get to the toilet | ☐ |
| | leaks when you cough or sneeze | ☐ |
| | leaks when you are asleep | ☐ |
| | leaks when you are physically active/exercising | ☐ |
| | leaks when you have finished urinating and are dressed | ☐ |
| | leaks for no obvious reason | ☐ |
| | leaks all the time | ☐ |

**Table 1.** International Consultation on Incontinence Questionnaire - Urinary Incontinence Short Form (ICIQ-UI SF).

| During the Past Month: | Never | Rarely | Occasionally | About Half the time | Most or all of the time |
|---|---|---|---|---|---|
| 1. How often has urine leakage occurred in association with any physical activity (such as lifting, bending, sitting down, standing up, exercising, etc)? | 0 | 1 | 2 | 3 | 4 |
| 2. How often has lifting light objects (such as a gallon of milk) caused you to leak urine? | 0 | 1 | 2 | 3 | 4 |
| 3. How often has walking or light exercise cause you to leak urine? | 0 | 1 | 2 | 3 | 4 |
| | Never | Seldom | About once a week | About once a day | More than once a day |
| 4. How often have you leaked urine because you could not wait to empty your bladder? | 0 | 1 | 2 | 3 | 4 |
| 5. How often has a sudden urge to urinate caused you to leak urine? | 0 | 1 | 2 | 3 | 4 |
| 6. How often have you leaked urine because you could not reach a bathroom in time? | 0 | 1 | 2 | 3 | 4 |
| | None | Thin pad or tissue | Medium/ regular pad | Large/maxi pad | Absorbent, disposable, undergarments |
| 7. On average, what form of protection do you use to protect against wetness during the day? | 0 | 1 | 2 | 3 | 4 |
| | None | 1 per day or less, or only for security | 1 per day and it is usually wet | 2-3 per day | 4 or more per day |
| 8. On average, how many of these (pads, tissues, disposable undergarments) would you use to protect against wetness during the day? | 0 | 1 | 2 | 3 | 4 |
| | | | | Total Severity Score: Items 1-8 | |
| | Never | Rarely | Sometimes | Most of the time | All of the time |
| 9. Overall, how often have you needed to change your daily activities because of your urinary incontinence? | 0 | 1 | 2 | 3 | 4 |
| | No problem | Very small problem | Small problem | Moderate problem | Big problem |
| 10. Overall, how big of a social problem (anxiety/embarrassment/ avoiding social activities) has your urinary incontinence been for you during the past month? | 0 | 1 | 2 | 3 | 4 |
| | | | | Total Bother Score: Items 9-10 | |

**Table 2.** Michigan Incontinence Symptom Index (M-ISI).

Office stress testing via valsalva or cough can be done to verify urine leakage and confirm SUI. The Male Stress Incontinence Grading Scale (MSGIS) may be employed as well; Yi et al found that increased grading on the MSGIS correlated well with increased 24-hour pad weight in men with SUI seeking surgical intervention.[21]

A 24-hour pad weight testing provides the most objective measure of daily urine leakage.[22] Pad number, in contrast, can be affected by patient age and activity level and may not accurately reflect the degree of urine lost.[23] However, formal 24-hour pad testing may be burdensome to the patient and logistically difficult to perform. The ICIQ-UI SF can additionally be correlated with both pad number and 24-pad weight testing and may be useful as a long-term tracking metric.

Evaluation with cystourethroscopy is recommended by the 2019 AUA/SUFU guidelines to rule out competing bladder/urethral pathology and to better define the patient's anatomy. Urethral stricture disease or vesicourethral anastomotic stenosis in the post-RP setting may be identified and necessitate a staged treatment approach. Urodynamic testing may also be used if the underlying diagnosis is unclear or if the patient's bladder function is questionable.[2]

For any patient the degree of bother should be the driving force behind treatment in the absence of concerning features. The American Urological Association Symptoms Score (AUA-SS) is an additional excellent tool to assess this and is easy to administer in the office.

## Pre-surgical management

After RP, patients should be offered PFMT as it has been shown to decrease time to continence recovery. Fernandez et al found in their meta-analysis of eight randomized trials that a regimen of three sets of 10 contractions daily led to improved short and long term continence rates compared to no therapy.[6]

Critical in pre-surgical management for post-RP patients specifically is to evaluate additional UUI. The main surgical treatments for SUI do not address UUI which may lead to worsened SUI surgical outcomes if left unmanaged. If UUI is identified it should be treated in accordance with the AUA/SUFU guidelines on Diagnosis and Treatment of Non-Neurogenic Overactive Bladder in Adults.[24] This includes a stepwise approach consisting of behavioral modifications, medical therapy, and surgical intervention as indicated.

Patients who have ongoing bothersome IPT with a significant component of SUI (which is typically the case) may be offered surgical treatment as early as 6 months postop. At that point it is important to decide if the patient's continence is continuing to improve or if it has plateaued. At 12 months patients still bothered should be offered surgical intervention if no contraindications exist.[2]

## Surgical management

### *Artificial urinary sphincter*

The artificial urinary sphincter has long been the gold standard for male SUI. The modern device consists of a pressure-regulating balloon (PRB), fluid-filled urethral cuff, and inflation pump. In AUS placement the patient is positioned in dorsal lithotomy and prepped. Flexible cystoscopy (if not done previously) is then performed to rule-out urethral stricture disease or vesicourethral anastomotic stenosis, both of which increase the risk for post-AUS failure and should ideally be treated before AUS placement.[25] After careful dissection to isolate the bulbar urethral the circumference is measured and a cuff size is selected. Men who have had prior AUS with urethral atrophy, prior urethral erosion, of pelvic radiation may require additional techniques such as double-cuff placement or transcorporal cuff placement to achieve satisfactory results.[2] Greater care should be taken in these patients especially at correct cuff sizing. After cuff placement the PRB is placed (typically into the space of Retzius) and filled with 23 mL of sterile saline or contrast corresponding to 61-70 cmH2O. The pump is placed into a subdartos pouch completing the procedure.

Excellent outcomes for the AUS have long been reported. The AMS 800 (Boston Scientific Corporation, Marlborough, MA, USA) is widely used with the most robust literature. In a large single-center series by Linder et al in 2015, 1,083 AUS placements between 1983-2011 were analyzed. For men with any degree of initial SUI, at a median follow up of 4.1 years 59% reported 0-1 pad per day and 94% reported high-satisfaction.[26] A systematic review by Van der Aa et al combined 12 AUS studies and found a general 0-1 pad per day rate of 61%-100% with "complete dryness" varying from 4%-86%.[27] Overall patients should be counseled that the effectiveness and durability of the AUS has been long tested and offers the potential for excellent results for any degree of SUI.

AUS revision does sometimes become necessary due to device failure or infection. In a recent cohort of 1,154 primary AUS implants, Boswell et al reported overall device survival of 72%, 56%, and 41% at 5, 10, and 15 years postop, respectively.[28] Historically sub-cuff atrophy was thought to be the leading cause of overall device failure. However, since the introduction of the 3.5 cm cuff, atrophy leading to failure may be less

common. Bergeson et al reviewed 177 AUS revisions between 2007-2019 of which only 8% were resultant from urethral atrophy. Notably there was only 1 case of atrophy leading to failure with a 3.5 cm cuff. In this series PRB failure was the most frequent cause of device failure (34%) followed by mechanical cuff failure (17%).[29]

Fortunately, long term satisfaction with AUS is excellent even after revision surgery. Viers et al reviewed a cohort of 467 primary AUS implants and 122 revision implants. Eight-five percent of men in his cohort had undergone RP and 26% had prior radiation therapy. At over 10 years follow up, satisfaction remained up to 75% with no difference between the primary and revision groups.[30] Patients should always be counseled on the possibility of device failure and need for revision surgery during preop office consultation.

## Male urethral sling

Male urethral slings are becoming more popular for use in male SUI. First developed in the 1960s and 1970s, multiple changes in design and materials over time have decreased complication rates and increased patient satisfaction. Physiologically male slings function by compression or repositioning of the urethra to increase outflow resistance.[31] However this process must be done without creating frank urinary obstruction. Several general designs have been developed including the bone-anchored male sling (BAMS), transobturator sling, adjustable sling, and the quadratic sling.[32]

One of the most studied modern urethral slings is the transobturator AdVance model sling (Boston Scientific, Minnetonka, MN, USA). Collado et al evaluated long term outcomes of the AdVance sling and AdVance XP sling for men with mild-to-moderate SUI (defined as 24-hour pad weight < 400 mL).[33] Inclusion criteria for this study also included a positive "repositioning test" whereby coaptation of the rhabdosphincter was assessed and confirmed during active contraction. The overall cure rate (defined as no pad use) among a total of 94 patients was 77% at a median follow up of 49 months. Small bladder capacity and DO were found to be predictive of surgical failure. A review by Doudt et al in 2018 identified a similar success rate among three studies of the AdVance or AdVance XP slings at between 74%-93%.[34] Recent studies of other sling types have shown similar results.[34]

With regard to adverse events, in 2018 Ye et al performed a review of outcomes and complications in seven studies using the AdVance sling.[35] They identified an acute urinary retention rate of 0.6%-15%, perineal pain rate of 0.8%-50%, and hematoma rate of 0.7%-3.2%. Explanation was uncommon and occurred in up to 1.6% during a period of 27 month follow up. Overall the complications after male urethral sling are reversible and should not be deterrent from pursuing sling if it is otherwise appropriate.

## AUS versus male urethral sling

Men who present with bothersome mild-to-moderate SUI are generally faced with a decision between pursuing AUS or male urethral sling. Both options are considered appropriate based on the 2019 AUA/SUFU guidelines, however several patient-specific factors must be taken into consideration.[2]

Raup et al found that cognitive dysfunction and decreased manual dexterity predicted overall AUS failure independent of age.[36] Men with such issues may ultimately enjoy better quality of life with male urethral sling. Bladder dynamics must be considered as well as prior studies have shown that DO increasesß the risk for worse outcomes after sling placement.[33] This is of particular importance given the risk of DO after radical prostatectomy (2%-63%) and after radiation therapy for prostate cancer (up to 85%).[10] The 2019 AUA/SFU guidelines recommend that AUS was the preferred option in the setting of pelvic RT given the lack of robust data for sling in this group.[2] Advances in sling technology may change this recommendation in the future.

Special consideration should be given to men seeking treatment for SUI after previously having an incontinence procedure. Ajay et al retrospectively reviewed 61 men who failed male urethral sling therapy and compared outcomes between revision with AUS vs revision with repeat sling.[37] Secondary treatment failure occurred in only 6% of those undergoing revision with AUS compared to 55% for repeat sling. Similarly, Lentz et al analyzed 29 men who underwent AUS placement after failing sling therapy and compared them to a control group of men undergoing primary AUS placement.[38] Men who received AUS after sling experienced similar results to primary AUS with 96% using 0-1 pads per day at 3 months. Overall, in the context of revision surgery after either AUS or male urethral sling, men should be counseled that secondary AUS placement is the preferred option and can have similar results to primary AUS.

The decision between AUS and male urethral sling must therefore be highly individualized. Poor manual dexterity/cognition and aversion to mechanical implants should direct towards male urethral sling. In contrast, a history of prior RT, the presence of DO, the need for revision surgery, or severe SUI (24-hour pad weight > 400 mL) should direct toward AUS.

## Urethral bulking agents

Urethral bulking agents have been studied as a minimally invasive treatment for male SUI. While the 2019 AUA/SUFU guidelines did list urethral bulking agents as a treatment option, it noted the low efficacy, high re-treatment rate, and rare chance for cure.[2]

## Conclusion

IPT remains a common and important problem for men and is associated with reduced quality of life. Evaluation of these men requires careful analysis of timing of urine leakage and associated symptoms. SUI, UUI, and mixed incontinence may manifest after RP, radiation therapy, or surgery for BPH and it is imperative for the urologist to determine the contribution of each type to men's symptoms. Surveys such as the ICIQ-UI SF and M-ISI are easy office assessment tools that should be part of the evaluation armamentarium.

SUI after RP remains the major driver for IPT. Advances in surgical technique in RP have reduced the rates of SUI, however this is still a significant problem. The benefits of PFMT in the prevention/improvement of SUI are well established and further research may refine the timing and implementation of these measures. The AUS and male urethral sling remain the most widely used and well-studied surgical interventions for male SUI. Long term data supports the AUS as the gold standard therapy which may be used regardless of SUI severity, bladder dynamics, prior radiation, or revision surgery. Men should be counseled on the risks and benefits of all available options and care should be taken to exclude competing pathology that may affect results. □

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