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Outcomes of Surgery for Stress Urinary Incontinence in the Older Woman

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Synopsis

As population demographics continue to evolve, specifics on age-related outcomes of stress urinary incontinence interventions will be critical to patient counseling and management planning. Understanding medical factors unique to older woman and their lower urinary tract condition will allow caregivers to optimize surgical outcomes, both physical and functional, and minimize complications within this population.

Keywords

age-related outcomes; stress urinary incontinence; older women; urogynecology; urology; counseling

Critical Need for Age-Related Outcomes

Introduction: Context for understanding age-related surgical outcomes

Prevalence rates of urinary incontinence (UI) increase with age. A large secondary analysis of the National Health and Nutrition Examination (NHANES) study revealed that the proportion of women that reported UI symptoms increased from 6.9% [95% CI, 4.9%-9.0%] in women aged 20 to 39 years, to 17.2% [95% CI, 13.9%-20.5%] in women aged 40 to 59

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years, to 23.3% [95% CI, 17.0%-29.7%] in women aged 60 to 79 years, and was 31.7% [95% CI, 22.3%-41.2%] in women aged 80 years or older; $P < .001$). (1) Further, as the US population aged 65 years and older continues to increase, women will be seeking surgical care for this condition in increasing numbers. (2-5)

Older women (≥ 65 years of age) have many more concerns with respect to undergoing stress urinary incontinence (SUI) surgery compared to younger women. Increasing medical morbidities including cardiac arrhythmias, use of blood thinners, diabetes and hypertension require optimization prior to surgery. Older women have an increased risk of postoperative morbidity and mortality compared to the younger woman. (6) Risk of perioperative complications were also noted to be higher in women ≥ 80 years of age compared to the younger woman, OR 1.4 [95% CI 1.3-1.5]. Attention to cognitive and functional outcomes as well as quality of life are also important to consider in this population.

Bladder physiology and function also changes with age. (7,8) In a recent study of 2 large cohorts of women undergoing SUI surgery, noninvasive maximum urinary flow decreased significantly with age (26.2 vs 22 ml per second, $p=0.002$). Noninvasive flow voiding time increased 2.7 seconds for each 10-year age increment and detrusor pressure at maximum flow decreased 2.1 cm H₂O for each 10-year increase in age (each $p=0.003$). Hypocontractility was more likely in women 65 years old or older (OR 2.89, 95% CI 1.59, 5.27). The bladder contractility index was inversely related to age, decreasing a mean±SD of 7.68 ± 1.96 cm H₂O for each 10-year age increase ($p<0.001$). These observed changes in voiding parameters suggest that detrusor contractility and efficiency decrease with age and will have implications for management of post-operative voiding function.

In the older woman, outcomes of surgery reflect all of these considerations and not just a negative cough stress test. The purpose of this review is to discuss outcomes and other important considerations in the setting of SUI surgery in the older woman.

Perioperative Considerations and Evaluation in Older Women

Pathophysiological changes to the lower urinary tract

Urinary symptoms, including urinary frequency, urinary urgency, nocturia, and UI are common conditions in older women and increase dramatically with age. The underlying etiology for the age-related onset of urinary symptoms is not completely understood, but is likely multifactorial resulting from sensory changes in the aging detrusor muscle, muscle loss of the levator ani muscle and urethral sphincter, physiologic changes in urine production, concurrent medications, and coexisting neurologic disease. (9) As women age, bladder capacity, detrusor contraction pressure during micturition, functional urethral length, and maximal urethral closure pressure decrease while post-void residual nocturnal urine production increase. (10-12)

Increased UI in the older woman is often not the sole result of sensory and muscle loss in the lower urinary tract, but the combination of systemic disease and functional decline impacting the lower urinary tract as well. Decreased mobility also impacts urinary

symptoms. Functional UI is the result “from physical or cognitive limitations [that prevent a person from] reaching or using the toilet” and common in older women. (13)

UI in older women is often considered a geriatric syndrome. (14) Geriatric syndromes are “highly prevalent multifactorial” health conditions that have substantial morbidity and are associated with adverse outcomes of aging in older adults including disability, nursing home admission, and mortality. Other common geriatric syndromes include delirium, falls, dizziness, and frailty. UI and functional dependence share many common risk factors and functional dependence has been demonstrated to be highly prevalent among older women with UI. (15,16) Studies examining adverse outcomes of aging demonstrate UI to be associated with increased mortality; however after adjusting for other comorbid conditions, incontinence was not demonstrated to be an independent predictor of mortality. (17) Because UI is not an independent predictor of mortality, incontinence is unique compared with other geriatric syndromes directly linked with increased mortality.

Preoperative evaluation of the lower urinary tract

Evaluation of women presenting with symptoms of SUI should include questions about type of incontinence (leakage with stress maneuvers, urgency, continuous leakage or leakage without awareness). (Table 1) Precipitating events, frequency of occurrence, severity, pad use, the impact of symptoms on activities of daily living and prior anti-incontinence procedures should be documented. Physical examination should include demonstration of urine leakage with visualization of leakage from the urethra with a stress maneuvers/cough termed a cough stress test. (19)

Evaluation should also include assessment for pelvic organ prolapse past the vaginal introitus, assessment for urethral mobility, post-void residual and urine analysis/urine culture to evaluate for the presence of hematuria and/or infection. Careful history and examination, especially a thorough review of patient medications, will determine if women have uncomplicated or complicated SUI. (Table 2)

Women with uncomplicated SUI without hematuria do not generally require urodynamic testing prior to considering surgical options. (21) Women with complicated SUI may benefit from additional testing including urodynamic testing or cystoscopy and upper urinary tract imaging if microscopic hematuria is present. (22)

Preoperative evaluation of the geriatric patient

Preoperative medical risk assessments should include a comprehensive cardiac history and can help to identify patients who will benefit from preoperative cardiac testing (stress test or coronary angiography) and perioperative beta-blocker use. The exact timing of initiation and duration of therapy is still under debate. (23,24) Medical evaluation to optimize medical comorbidities and identify modifiable risk factors is recommended. (25) This includes reducing polypharmacy, substance abuse interventions, smoking cessation, nutritional improvement, and increasing preoperative activity to increase aerobic capacity prior to anesthesia.

There is a growing body of evidence demonstrating that combining measurements of frailty, functional status, mobility and cognitive function are important predictors of surgical outcomes and have increased prognostic ability to predict postoperative complications after surgery better than medical comorbidities or American Society of Anesthesiologists (ASA) status alone. (26-31) Frailty is a common biologic syndrome of decreased reserve and resistance to stressors that increases with age. (32) Markers of frailty can be measured before an overt functional disability (decline in functional status and increased functional dependence) is evident. (26,32) A joint best-practice guideline statement from the American College of Surgeons (ACS) and the American Geriatrics Society (AGS) recommends that, in addition to routine assessment and optimization of medical conditions, all older adults undergoing surgical procedures should be assessed for frailty, cognitive ability, and functional status in the preoperative period. (25)

To streamline geriatric preoperative assessment, Robinson et al. developed a simple predictive tool combining clinical measures of frailty with cognitive status and functional disability. (29) This preoperative assessment tool includes 6 measurements: Mini-Cog score, Charlson comorbidity index, functional disability, history of falls, preoperative serum albumin, and preoperative serum hematocrit. The Mini-Cog is a simple cognitive screening test that combines clock drawing with 3-object recall. (33) To assess for mobility, the Timed Get Up and Go test has been advocated as a preferred measure and demonstrated by Robinson et al. to be an effective predictor of postoperative complications. (34,35) (Table 3) These simple screening tools have been proven impactful in vascular surgery, general surgery, and colorectal surgery. (27,35-38) More research needs to determine the impact of preoperative geriatric screening in older women undergoing surgery for UI on outcomes, both immediate postoperative complications and overall quality-of-life.

Surgical Interventions and Outcomes

Urethral Bulking Agents

Injectable agents, either injected transurethrally or periurethrally, to add bulk to the proximal urethra have been documented to improve stress urinary incontinence symptoms in women who either do not want to undergo more invasive surgery or who are not surgical candidates due to medical comorbidity. Advantages of injectable urethral bulking agents, especially in older women, include that this is a procedure easily performed in the office setting, that many women tolerate well without anesthesia, and anti-coagulation does not always need to be stopped prior to injections. Injectable agents are divided into two categories: collagen, which degrades over a 6 to 12 month period requiring repeat injections, and nondegradable synthetic agents. These synthetic agents are usually beads or particles of varying sizes and have included silicone particles, calcium hydroxylapatite, carbon spheres, ethylene vinyl alcohol, and dextranomer hyaluronic acid. (39,40)

The American Urological Association (AUA) review on efficacy of urethral bulking agents concluded that treatment efficacy for these agents was present, but declined over time with the anticipated efficacy of collagen injection to be 48% at 12 to 23 months with a decreased efficacy at 32% at 24 to 47 months. (22)

Complications of bulking agents include urinary retention and urinary tract infection. The chances of allergic reaction to collagen is 4% and skin-testing to evaluate for possible allergic reaction is recommended prior to collagen injection. (22) Collagen is currently not manufactured for use in the United States. There are also complications unique to non-degradable synthetic agents including bead migration with rare events such as distant arterial thrombosis reported, vaginal and urethral erosion, and periurethral abscess. (39-43) These complications vary depending on the properties of the non-degradable injection agent being used.

Burch Colposuspension and Pubovaginal (Autologous Rectus Fascia) Sling

Prior to the advent of today's minimally invasive midurethral sling (MUS) techniques, two of the most common surgical intervention options for the treatment of SUI were the Burch colposuspension and the pubovaginal sling. The Burch colposuspension was first described in the early 1960s and reported cure rates of almost 90%. (44-45) This procedure has been modified over the years and currently, it involves the suspension of the anterior wall, at the level of the bladder neck, to the iliopectineal ligament. (46) In the pubovaginal sling, a strip of rectus fascia is harvested and positioned at the proximal urethra transvaginally. The upper portion of the sling is then secured to the rectus fascia with permanent sutures. (47) Both procedures have reported long-term cure rates of 70 to 85%. (48,49) In the Stress Incontinence Surgical Treatment Efficacy Trial (SISTER), the Burch colposuspension and the pubovaginal sling (autologous rectus fascia) were compared in a multi-center, randomized trial of women with uncomplicated SUI. The primary outcomes were success in terms of overall incontinence measures including a negative pad test, no UI on a 3-day diary, a negative cough and Valsalva stress tests, and no retreatment of the condition. At 24 months, success rates were higher for women who underwent the pubovaginal sling operation compared to the Burch colposuspension for the category specific stress incontinence (66% vs. 49%, $p<0.01$); however, more women in the pubovaginal trial arm had urinary tract infections, difficulty voiding, and post-operative urgency urinary incontinence (UUI). (50)

Regarding age-related outcomes for these procedures, Carr et al. reported a retrospective cohort of 19 women (> 70 years) undergoing a modified pubovaginal (autologous rectus fascia) sling compared to 77 younger women with a mean follow-up of 22 months. (51,52) There were no reported differences in outcomes between the older-aged and control group. A more robust study involving a planned secondary analysis of the SISTER Trial evaluated two-year outcomes in older women (≥ 65 years of age) versus younger women and revealed that older women were more likely to have a positive stress test at follow-up (OR 3.7, 95% CI 1.70-7.97; $p=0.001$) and less subjective improvement in SUI and UUI measured by the Medical and Epidemiologic Social Aspects of Aging questionnaire (MESA). (53,54) In addition, there was no difference in postoperative adverse events, but older women were more likely to undergo surgical retreatment for SUI. (53)

Despite the effectiveness of these procedures, the minimally-invasive, MUS procedures, both the transvaginal, retropubic, tension-free vaginal tape (TVT) and the transobturator vaginal tape (TOT) are increasingly recognized as the gold standard of care for the surgical

intervention and treatment of SUI. For the purposes of this review, we restrict the remaining portion of our discussion to these procedures. (55,56)

Midurethral Sling

Midurethral slings utilizing synthetic material for the treatment of female SUI were first described in 1996 by Ulmsten. (55) These minimally-invasive surgical procedures involve placement of a permanent mesh of knitted polypropylene by tactile sensation through the retropubic space at the level of the midurethra and eliminating the need for full dissection of the retropubic space or harvesting autologous fascia. The decreased dissection results in decreased surgical time and surgical site morbidity compared with other anti-incontinence procedures. In 2001, an alternative route placing the synthetic mesh through the obturator foramen was first described. (56) The rationale of the transobturator approach was to minimize the potential of inadvertent bladder and bowel perforation. A large randomized controlled equivalence trial of the retropubic and transobturator sling routes demonstrated equivalence of efficacy and safety of these two approaches. (57) Furthermore, a large non-inferiority randomized controlled trial reflected results where the transobturator approach was non-inferior to that of the retropubic sling results. (58) Both of these MUS routes utilize minimal dissection and can be performed as outpatient procedures.

Long term efficacy data exists for both MUS routes. A recent analysis of health care claims data within the United States over a 9 year period, which included 127, 848 sling surgeries (including pubovaginal slings), revealed that the cumulative incidence of repeat surgery was relatively low (13.0 %, 95% CI 11.7-14.3) (59) A recent report of 10-year subjective outcome from a retrospective cohort of 54 women who underwent retropubic (TVT) surgery for urodynamically confirmed SUI, revealed that 65% of women in this cohort considered their condition cured. (60) In contrast, a cohort of 69 women that had undergone TVT for primary SUI, reported subjective cure at 77%. The remainder of the cohort reported their condition as improved (20%), and only 3% regarded the operation as a failure. (61)

The minimally-invasive nature of the MUS has increased the number of women, especially older women, who may be considered surgical candidates for anti-incontinence procedures. Multiple retrospective and prospective cohorts have reported on favorable outcomes of older women undergoing these procedures. (Table 4)

There are increasing numbers of age-related outcomes data for women undergoing MUS procedures for stress urinary incontinence. Recently, Stav, et al. reported a prospective trial of women undergoing MUS procedures for SUI, comparing 96 patients (≥ 80 years) to a cohort of 1016 patient (< 80 years). In this study, there was no difference in overall cure rate between the older and younger women. Though hospitalization time was significantly longer in the older women cohort, major perioperative complications were uncommon (1%) and the rate of bladder perforation, long-term voiding difficulty, and *de novo* UII was similar between the groups. (74) Similarly, for the TOT approach, Groutz et al. reported age-related outcomes for a prospective study of 97 patients (≥ 70 years of age) versus 256 younger women, undergoing surgery for SUI. In this study, the TOT approach was noted to be safe and efficient for both cohorts, but older women were noted to have increased risks for perioperative recurrent urinary tract infections as well as *de novo* overactive bladder. (65)

An additional prospective study evaluating the TOT approach included 60 patients > 70 years of age and 121 patients < 70 years of age. There were no differences observed between the two groups in terms of cure rates or complications. A recent study compared primary MUS outcomes in 160 women (> 70 years of age) to 536 women (< 70 years of age). Multivariable analysis revealed no differences in SUI failure rates in older compared to younger cohorts, adjusted OR 1.7, 95% CI: 0.9-3.1.) Despite similar SUI outcomes, older women had greater persistent UII and worse impression of improvement. (70)

Age-Related Surgical Outcomes

There is conflicting information in the peer-reviewed literature on the impact of age on surgical outcomes. (79) Large datasets demonstrate age as an independent predictor of adverse outcomes after surgery. Sung et al. demonstrated that increasing age is associated with very small increases in absolute risks of complications in older women after surgery for UI and other pelvic floor disorders. (80) However, the relative risk of complications in older women was significantly increased compared with their younger counterparts. This is consistent with studies reporting on postoperative complications analyzing large datasets from general, colorectal, vascular and gynecologic surgery demonstrating increasing age, especially age greater than 80 years is associated with increased complications. However, many single-institution cases series have reported excellent surgical results with well-selected octogenarians and nonagenarians undergoing surgeries for incontinence and other pelvic floor disorders. (81-83) The findings of these case-series should be considered with caution as they tend to describe healthy well-selected older women undergoing procedures at specialized centers. The true risk of surgery in older women is likely higher. Considering medical comorbidities, frailty, and functional status in addition to age will help surgeons better lead discussions with women on their individual risk of complications after surgery.

Treatment failure after midurethral sling

Risk factors for treatment failure of MUS at 12 months have been examined and noted to be prior anti-incontinence surgery, an immobile urethra (with urethral mobility documented at less than 30°), and indicators of incontinence severity including increase symptom bother on validated surveys and increased pad weight on 24 hour pad tests. (84)

Post-operative Complications

TOT and TVT midurethral sling procedures are overall considered a safe and effective procedure; however, there are several surgically related complications that must be carefully considered. Bladder and vaginal perforation, hematoma formation, neurological symptoms, including numbness and weakness, pain, and mesh exposure as well as complications specific to the lower urinary tract, including voiding dysfunction, and new onset and persistent UII, are well documented. In a recent systematic review, Novara et al. compared TVT and TOT sling complications, reviewing 27 randomized controlled trials (4,224 patients) reporting bladder/vaginal perforations, and noted an OR of 2.5 (1.75-3.57, 95% CI) favoring the TOT approach. Regarding vascular complications, the same systematic review evaluated 19 RCTs (2,927 patients) reporting hematoma formation after MUS with an OR of 2.62 (1.35-5.08, 95% CI) favoring the TOT approach. For mesh complications, review of 25

RCTs (3,837 patients) reporting vaginal erosion revealed an OR of 0.64 (0.41-0.97, 95% CI) favoring TVT. (85) In the most recent, aforementioned large, equivalence randomized controlled trials comparing the TVT and TOT sling routes, there were no differences in mesh exposure rates or surgical-site infections, but there were higher rates of vascular events in the TVT arm as compared to the TOT arm (6.0% vs. 2.3%, $p = 0.03$). Regarding neurologic symptoms, patients undergoing the TOT approach reported a higher incidence of complications, (9.4% vs. 4.0%, $p = 0.01$). There were no differences in pain between the groups. Lower urinary tract complications, including voiding dysfunction, new UUI, and persistent UUI were similar between the study groups. (57)

Age-related risk of other specific complications of incontinence surgery is not well delineated in the medical literature, and attention to general post-operative complications within the geriatric population is prudent. Despite, limited data that addresses age-related risk specifically for incontinence surgery, Anger et al, analyzed the 1999-2001 Medicare Public Use Files and reported on 1,356 female medicare beneficiaries (≥ 65 years and older) undergoing sling surgery and noted, high rates of urinary tract infections (33.6%) in the early post-operative period, and 49.7% at 1 year. In addition, 9.4% of subjects reported new onset pelvic pain. (86) Regarding complications specific to the lower urinary tract, there were high incidences of new onset UUI and outlet obstruction. (86) (Table 5). Of note, multivariate analysis revealed that patient race, age, and comorbidities each had a significant influence on outcomes.

Geriatric postoperative considerations

Common geriatric postoperative medical complications that should be considered in all older women undergoing surgery are falls, delirium, and surgical site infections. (87) As anti-incontinence procedures are commonly considered outpatient procedures by Medicare, women are often not discharged to skilled nursing facilities. The rates of discharge to skilled nursing facilities, 30-day readmissions, and 2 year postoperative mortality are not well described in the peer-reviewed literature.

- Postoperative falls are common although the true prevalence of postoperative falls is not known. Thirty percent of community dwelling adults over 65 years old fall every year and 10% of these falls result in major injury or sequelae including fracture, serious soft tissue injury, traumatic brain injury, dehydration, pressure ulcers, and rhabdomyolysis. (88) Risk factors predisposing older adults to falls include previous fall, balance impairment, gait disturbances, decrease muscle strength, visual impairments (including cataracts), polypharmacy (> 4 medications), functional impairment for ADLs, depression, low body mass index, age > 80 years, female gender, and cognitive impairments. (88) In the postoperative period, narcotic use, dehydration, and urinary tract infections may all contribute to falls in older women undergoing surgery for incontinence.
- Delirium is a state of acute confusion and is common complication reported in 9% of older adults undergoing major surgery. Unfortunately, 50 to 80% of acute episodes of delirium in hospitalized patients go unrecognized because patients are often not screened postoperatively. Risk factors for postoperative delirium after

surgery are well defined and include age > 70 years, alcohol abuse, preoperative cognitive impairment, preoperative physical impairment, and abnormal serum sodium (<130 or >150 mmol/L), potassium (<3.0 or >16.7mmol/L), or glucose (<60 or >300mg/dL). (89) In a study of women > 60 years undergoing gynecologic surgery, age >70 years, taking > 5 medications, and additional narcotic dosing to supplement intravenous patient-controlled analgesia were identified as independent predictors of postoperative delirium. (90) The National Institute for Health and Clinical Excellence (NICE) from the United Kingdom has published recommendations for the prevention of delirium. These include assessing patients on admission for their risk factors for developing delirium and screening patients for incident delirium by assessing for changes in cognitive function.

- Surgical site infections have long been associated with increasing age. Impaired functional status for activities of daily living (ADLs) has emerged as an important independent predictor of surgical site infection, especially methicillin-resistant *Staphylococcus aureus* infections, even after stratifying patients by age. (91) Two hypotheses to explain this is that decreased nutritional status in dependent patients predispose to infection and poor wound healing. Alternatively, this could be due to health care workers spreading infections between dependent patients requiring increased wound care.

Summary/Need for Further Investigation

Surgery has been proven highly effective for the treatment of SUI in women participating in large clinical trials, but carries risks of postoperative complications. Well-selected older women have been demonstrated to do well with anti-incontinence surgery and have significant gains in QOL. Major gaps in our knowledge exist about which surgical treatments will benefit individual women who may not have been represented in clinical trials due to age, multiple comorbidities, functional disability, or cognitive impairment. Research to identify which treatments for UI are most appropriate in real world settings for different older women is needed.

As anti-incontinence procedures are commonly considered outpatient procedures by Medicare, women are often not discharged to skilled nursing facilities. Common geriatric complications including the rates of postoperative delirium, discharge to skilled nursing facilities, 30-day readmissions, 30-day falls, and 2 year postoperative mortality after anti-incontinence surgery and surgery for pelvic floor disorders are not well described in the peer-reviewed literature. Research that includes preoperative geriatric assessments, such as the Robinson Predictive tool and the Timed Get Up and Go test, in prospective surgical trials of older women undergoing surgical procedures for UI coupled with measurements of postoperative geriatric morbidity will help to establish the actual risk of these complications in older women resulting in improved patient counseling and surveillance.

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Key Points

- Women aged 65 years and older have many unique age-related concerns that are critical to optimizing patient care and surgical outcomes.
- Older women may have increased co-morbidities resulting in decreased physical reserve. Careful pre-operative evaluation is paramount to avoid adverse geriatric postoperative outcomes that often including falls, disability, nursing home admission, and mortality.
- Several minimally-invasive surgical interventions exist for the treatment of stress urinary incontinence and are well tolerated in older women. Balancing risks and benefits of each of these management options is imperative.
- Differences in surgical outcomes between older and younger women may reflect changing physiology with aging. Robust patient counseling regarding available data may inform to patient expectations of outcomes.
- As the population of older women continues to expand, robust data on age-related outcomes of stress urinary incontinence interventions are needed to enhance patient counseling and outcomes.

Table 1
Basic Evaluation Findings for Uncomplicated vs. Complicated SUI

	Findings	
Evaluation	Uncomplicated	Complicated
History *	UI associated with involuntary loss of urine on effort, physical exertion, sneezing, or coughing	Symptoms of urgency, incomplete emptying, incontinence associated with chronic urinary retention, functional impairment, or continuous leakage
	Absence of recurrent urinary tract infection	Recurrent urinary tract infection ^f
	No prior extensive pelvic surgery No prior surgery for SUI	Previous extensive or radical pelvic surgery (eg, radical hysterectomy)
		Prior anti-incontinence surgery or complex urethral surgery (eg, urethral diverticulectomy or urethrovaginal fistula repair)
	Absence of voiding symptoms	Presence of voiding symptoms: hesitancy, slow stream, intermittency, straining to void, spraying or urinary stream, feeling of incomplete voiding, need to immediately revoid, post-micturition leakage, position-dependent micturition, and dysuria
	Absence of medical conditions that can affect lower urinary tract function	Presence of neurologic disease, poorly controlled diabetes mellitus, or dementia
Physical examination	Absence of vaginal bulge beyond the hymen on examination Absence of urethral abnormality	Symptoms of vaginal bulge or known pelvic organ prolapse beyond the hymen confirmed by physical examination, presence of genitourinary fistula, or urethral diverticulum
Urethral mobility assessment	Presence of urethral mobility	Absence of urethral mobility
Postvoid residual urine volume	Less than 150mL	Greater than or equal to 150mL
Urinalysis/urine culture	Negative result for urinary tract infection or hematuria	

Adapted from American College of Obstetricians and Gynecologists and American Urogynecologic Society Joint Committee Opinion: Evaluation of Uncomplicated Stress Urinary Incontinence in Women before Surgical Treatment. Number 603. June 2014; with permission.

UI = Urinary Incontinence,

SUI = Stress Urinary Incontinence

* A complete list of the patient's medications (including nonprescription medications) should be obtained to determine whether individual drugs may be influencing the function of the bladder or urethra, which leads to urinary incontinence or voiding difficulties.

^f Recurrent urinary tract infection is defined as three documented infections in 12 months or two documented infections in 6 months.

Table 2
Medications That Can Affect Lower Urinary Tract Function

Type of Medication	Lower Urinary Tract Effects
Diuretics	Polyuria, frequency, urgency
Caffeine	Frequency, urgency
Alcohol	Sedation, impaired mobility, diuresis
Narcotic analgesics	Urinary retention, fecal impaction, sedation, delirium
Anticholinergic agents	Urinary retention, voiding difficulty
Antihistamines	Anticholinergic actions, sedation
Psychotropic agents	
<ul style="list-style-type: none"> • Antidepressants • Antipsychotics • Sedatives and hypnotics 	<ul style="list-style-type: none"> • Anticholinergic actions, sedation • Anticholinergic actions, sedation • Sedation, muscle relaxation, confusion
Alpha-adrenergic blockers	Stress incontinence
Alpha-adrenergic agonists	Urinary retention, voiding difficulty
Calcium-channel blockers	Urinary retention, voiding difficulty

Adapted from American College of Obstetricians and Gynecologists Practice Bulletin: Urinary Incontinence in Women. Number 63. June 2005; with permission.

Table 3
Preoperative Assessments: The Robinson Frailty Index

Frailty Characteristic	Scale explanation	Score	Cut-off value	Points
Mini-Cog	3-item recall (1 point per item) paired with clock drawing test (2 points)	Scores range from 0 (impaired cognition) to 5 (normal cognition)	<4	1
Katz ADL Score	1 point for each of six basic ADLs that patient is able to perform independently (bathing, dressing, toileting, transferring in/out of bed, walking, and feeding)	Scores range from 0 (totally dependent) to 6 (independent)	<6	1
Charlson Comorbidity Index	16 items medical comorbidity assessment	Scores range from 0 (no comorbid conditions) to 33 (severe co-morbidity)	3	1
History of falls	Recorded answer to the question "How many times have you fallen in the last 6 months?"		1 fall	1
Preoperative serum albumin	Indicative of poor nutritional status		3.3 g/dL	1
Preoperative serum hematocrit	Indicative of anemia of chronic disease		<35%	1
Timed Up and Go *	Patient sits in an armless chair and is timed to: Rise from chair Walk 10 feet Turn around Walk 10 feet Sit back down in chair	10 seconds (fast) 11-14 seconds (intermediate) 15 seconds (slow)	15 seconds	

Adapted from Ferrucci L, Guralnik JM, Studenski S, Fried LP, Cutler GB, Jr, Walston JD, et al. Designing randomized, controlled trials aimed at preventing or delaying functional decline and disability in frail, older persons: A consensus report. *J Am Geriatr Soc.* 2004 Apr;52(4):625-34; and Robinson TN, Wu DS, Sauaia A, Dunn CL, Stevens-Lapsley JE, Moss M, et al. Slower walking speed forecasts increased postoperative morbidity and 1-year mortality across surgical specialties. *Ann Surg.* 2013 Oct;258(4):582,8; discussion 588-90.

* walking aids are allowed and no instructions are given to the patient about the use of their arms

Table 4**Tension-Free Vaginal Tape (TVT) – Outcomes in the Older Woman**

References	Study Details	Outcomes	Comments
Allahdin et al ⁶²	179 patients in three age cohorts; 30-49, 50-69, and 70-90 years of age, TVT for SUI, prospective	1-year subjective cure rate 84.9, 81.3, and 85.3% in each respective cohort	Higher incidence of post-operative urgency in older cohort (9.5%)
Centinel et al ⁶³	75 patients, median age 51.2 years (range 33-69 years), predictors for continence after TVT, prospective	Subjective and objective outcome measures, mean follow-up 21.6 months, cure rate 95.9 versus 76.9% in patients < versus > 55 years of age, respectively	Only statistically significant parameter affecting cure rate was age > 55 years
Gordon et al ⁶⁴	123 patients 70 years of age versus 208 patients < 70 years of age (control group), TVT, prospective	Objective follow-up, mean \pm SD follow-up 26 \pm 13 months, persistent SUI 7% in older group versus 6% in younger group	<i>De novo</i> post-operative urge UI more common in older group (18 versus 4%), older group with 2 cases of pulmonary thromboembolism, 1 DVT, 2 cardiac arrhythmia, and 1 pneumonia
Groutz et al ⁶⁵	97 patients (70 years of age) versus 256 younger women, TVT-O, prospective	Mean follow-up 30 \pm 17 months (3-58 months), early and late post-operative morbidity was similar in both groups, incidence of persistent SUI incontinence was similar in both age groups	More recurrent UTIs among elderly women (13.7% versus 6.2%) <i>De novo</i> OAB was more common in elderly patients (11.9% versus 4.7%, $p < 0.05$)
Hellberg et al ⁶⁶	113 patients 75 years of age versus younger cohort, TVT, retrospective	Mean follow-up 5.7 years, cure rate 55.7 versus 79.7% in older versus younger cohort, respectively	Mixed UI, UTI, and previous surgery no related to outcomes
Karantanis et al ⁶⁷	34 patients 65 years of age versus younger group, case control	Follow-up 6-23 months, subjective continence cure rate 45 versus 73% and satisfaction rate 90 versus 100% in older versus younger patients, respectively	Older group had lower outcome satisfaction, equivalent post-operative urge symptoms
Ku et al ⁶⁸	60 patients (65 years of age) versus 206 younger women (45-64 years of age), TVT and SPARC, retrospective	Objective and subjective outcome measures, mean follow-up, 10.4 months, no significant difference in cure rate	No significant differences between the groups for the rates of postoperative UUI
Liapis et al ⁶⁹	51 patients 65 years of age, TVT	Objective follow-up, > 12 months, 76% dry	Better outcome with pre-operative hypermobile urethra
Malek et al ⁷⁰	160 women (70 years of age) versus 536 younger women, TVT and TOT, retrospective	Subjective outcome measures, mean follow-up 38 months, no difference in SUI failure rates in older compared to younger women	Older women had more persistent UUI and worse impression of improvement than younger women.
Pugsley et al ⁷¹	34 patients 70 years of age versus 192 younger controls, colposuspension versus TVT, retrospective	Subjective measure, three-month post-operative cure or improvement for TVT was 77.3 versus 89.3% and for colposuspension was 81.8 versus 89.4% in older versus younger patients, respectively	Post-operative voiding dysfunction, UTI, and irritative symptoms more common in older group with either surgery
Sevestre et al ⁷²	76 patients 70 years of age	Subjective and objective measures, mean follow-up 24.6 months, 67% cured, 82% satisfied	<i>De novo</i> urgency rate 21 %, pre-operative urgency cured in 46%
Serati et al ⁷³	60 patients > 70 years of age	Subjective and objective	No differences in post-

References	Study Details	Outcomes	Comments
	versus 121 younger patients, comparing TVT-O, prospective	measures, mean follow-up 26 months, no differences in cure rate	operative voiding dysfunction, vaginal erosion, or <i>de novo</i> overactive bladder
Stav et al ⁷⁴	96 patients 80 years of age versus 1016 younger patients, comparing TVT to TOT	Subjective measure, 6 weeks, 6, 12, 18, and 24 months using validated measures. Overall subjective cure rate was 85% (elderly group 81 %, young group 85%, $p = 0.32$) There was no difference between TVT and TOT approaches for the elderly group	The rate of <i>de novo</i> urgency was similar between the two groups 37% of older women failed their first voiding trial compared to 9% in the younger cohort ($p < 0.001$) Patient's age was not found to be an independent risk factor for sling failure.
Sung et al ⁷⁵	81 patients 60 years of age versus 168 younger women, comparing quality of life (QOL) outcomes, retrospective	Subjective outcomes, mean follow-up 11.8 months, improved QOL in both cohorts	Older women had lower mean baseline subjective QOL scores but there was no difference in improved QOL post-operatively
Touloupidis, et al ⁷⁶	51 patients 65 years of age, TVT, retrospective	SUI cure rate 96%, follow-up 35.6 months (range 14-60 months), mailed questionnaire	9.8% <i>de novo</i> urgency, maximum urine flow rate unchanged before versus after surgery
Walsh et al ⁷⁷	21 patients 70 years of age versus 46 patients < 70 years of age (control group), prospective	Significant improvement of SUI, UI, frequency, and urgency in both groups on King's Health Questionnaire, mean follow-up 9-12 months	Younger cohort had better improvement scores, older cohort had more previous surgery for SUI

Adapted from Gerten KA, Markland AD, Lloyd KL, et al. Prolapse and incontinence surgery in older women. J Urol. 2008;179:2111-18; with permission.

DVT = deep vein thrombosis; SD = standard deviation; SUI = stress urinary incontinence; TVT = tension-free vaginal tape; UI = urinary incontinence; UTI = urinary tract infection.

Table 5
Surgical Outcomes Among Medicare Beneficiaries

Characteristics	Treatment Failure (Repeat Incontinence Procedure)	New Diagnosis of Urgency Urinary Incontinence	Diagnosis of Urinary Obstruction	Management of Outlet Obstruction
Nonwhite (versus white)	1.81 (0.84-3.87)	1.46 (0.75-2.84)	2.30 (1.07-4.91) [†]	1.78 (0.84-3.78)
Ages 65-69 years (versus more than 75)	0.53 (0.32-0.87) [†]	0.44 (0.29-0.65) [†]	0.60 (0.34-1.03)	0.58 (0.36-0.94)
Ages 70-74 years (versus more than 75)	0.76 (0.48-1.22)	0.84 (0.58-1.20)	1.0 (0.60-1.65)	0.58 (0.35-0.95) [†]
Charlson 1 or more (versus 0) [‡]	1.09 (0.71-1.66)	1.26 (0.91-1.74)	0.74 (0.46-1.21)	1.23 (0.81-1.88)

Adapted from Anger JT, Litwin MS, Wang Q. Complications of sling surgery among female Medicare beneficiaries. *Obstet Gynecol.* 2007;109:707-714; with permission.

Data are expressed as odds ratios (95% confidence intervals)

* 0.05 < P < 0.10

[†] P < 0.05

[‡] Charlson Comorbidity Index Score