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Mixed Urinary Incontinence: Contemporary Perspectives on Pathophysiology, Diagnosis, and Evidence-Based Management for Nursing

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Abstract

Background: Mixed urinary incontinence (MUI), the co-occurrence of stress and urge incontinence, is a prevalent and burdensome condition, especially among older women. It significantly impairs quality of life, increases fall risk, and contributes to social isolation. The pathophysiology involves a complex interplay of pelvic floor weakness (causing stress leakage) and detrusor overactivity (causing urgency).

Aim: This review aims to provide contemporary nursing and clinical perspectives on the pathophysiology, diagnostic evaluation, and evidence-based management of MUI, emphasizing a stepwise, patient-centered approach.

Methods: A comprehensive synthesis of current literature and guidelines from major urological and gynecological societies is presented. The review covers epidemiology, risk factors, and the diagnostic pathway, including history, physical exam, bladder diaries, cough stress test, and selective use of urodynamics. Both non-surgical and surgical management strategies are detailed.

Results: Evaluation begins with a detailed history, physical exam, urinalysis, and post-void residual measurement. First-line management is conservative, including bladder training, pelvic floor muscle therapy (e.g., the Knack technique), lifestyle modifications, and pharmacotherapy (e.g., antimuscarinics, mirabegron) for the urge component. For predominant stress incontinence refractory to conservative care, mid-urethral sling surgery is the standard, though pessaries, bulking agents, and adjustable devices are alternatives. Specialist referral is indicated for complex cases, surgical planning, or treatment failure.

Conclusion: Effective MUI management requires accurate diagnosis of the dominant component and a multimodal treatment plan initiated with conservative strategies. Successful outcomes depend on interprofessional collaboration, realistic patient expectations, and individualized care.

Keywords: Mixed urinary incontinence, Pelvic floor muscle training, Bladder training, Mid-urethral sling, Antimuscarinics, Urodynamics.

Introduction

Urinary incontinence is defined as the involuntary loss of urine and encompasses a spectrum of symptom severity, from occasional minor leakage to continuous and socially disabling wetness. Regardless of degree, it frequently exerts a profound negative influence on physical comfort, psychosocial well-being, and overall quality of life. Recognizing the need for standardized terminology and classification, the International Urogynecological Association (IUGA), the International Continence Society (ICS), and the American Urological Association (AUA) have jointly delineated urinary incontinence into three primary categories, thereby providing a common framework for clinical assessment, research, and treatment planning.[1][2] (See StatPearls' companion reference, "Urinary Incontinence," for further background on the general condition.[2] Stress urinary incontinence refers to involuntary urine leakage that occurs in association

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with activities or events that acutely increase intraabdominal pressure, such as coughing, sneezing, laughing, jumping, lifting, straining, or exercising, in the absence of a concurrent detrusor contraction.[3] By contrast, urge urinary incontinence is characterized by involuntary urine loss preceded or accompanied by a sudden, compelling desire to void that is difficult or impossible to defer, typically reflecting detrusor overactivity.[4] More detailed discussions of these individual entities are provided in the StatPearls companion chapters "Urge Incontinence" and "Stress Incontinence."[4][3] Mixed urinary incontinence (MUI) is diagnosed when features of both stress and urge incontinence coexist in the same patient, often with overlapping symptomatology and pathophysiological mechanisms.[2][5] This dual nature of MUI complicates evaluation and management, as patients may exhibit varying dominance of stress or urge components over time. Epidemiologically, MUI is especially common among older women. In those over 65 years of age, mixed symptoms are reported in more than 37% of patients, making it one of the most prevalent forms of urinary incontinence in this demographic.[6][7][8] The condition frequently necessitates substantive lifestyle modifications, as individuals often adapt their daily routines, fluid intake, social activities, and occupational engagement to anticipate and manage episodes of leakage. The cumulative burden of these adjustments underscores the substantial impact MUI has on both physical and psychosocial domains.

Although urinary incontinence is not inherently life-threatening, accumulating evidence suggests that it may be associated with increased mortality in certain populations. A meta-analysis of six studies encompassing 1,656 individuals demonstrated that urinary incontinence was associated with a roughly 20% increase in mortality among nursing home residents, highlighting the condition as an important marker of frailty and overall health vulnerability in institutionalized older adults.[9] More commonly, however, the primary consequences of MUI are its wide-ranging effects on morbidity and quality of life. Chronic moisture and maceration of the skin can predispose to dermatologic and mucosal complications, including perineal and vaginal infections, cellulitis, and candidal overgrowth.[10][11] Additionally, the need for frequent and urgent trips to the bathroom, especially at night, significantly increases the risk of falls and fractures, particularly in older individuals who may already have impaired mobility or balance.[10][11] In postmenopausal women, the incidence of falls has been shown to be approximately doubled in those with urinary urgency and urge incontinence compared with age-matched peers without these urinary symptoms, emphasizing the functional and safety implications of the condition.[11][12] Beyond physical complications, the psychosocial repercussions of urinary incontinence, including MUI, are profound and well documented. Affected individuals often experience embarrassment, shame, and a pervasive fear of visible leakage or odor, leading to reduced social participation and, in many cases, progressive isolation.[13][14][15][16][17] These experiences can contribute to clinically significant anxiety and depressive symptoms, diminished work productivity, sleep disruption due to nocturia, and a persistent sense of loss of control and diminished self-esteem.[13][14][15][16][17] Sexual function is also frequently compromised; up to one-third of incontinent patients report coital incontinence—urine leakage during sexual activity—which can markedly reduce sexual satisfaction and lead to avoidance of intimacy.[18][19][20][21][22][23] The anticipatory anxiety surrounding potential leakage during intercourse often has a deleterious effect not only on sexual enjoyment but also on intimate relationships and overall relationship quality. The effects of MUI extend beyond the individual patient to caregivers and healthcare systems. Family members and professional caregivers may face increased burdens related to toileting assistance, hygiene management, laundry, and emotional support, particularly when incontinence is severe or associated with cognitive impairment.[24][25][26] Institutional care settings are similarly impacted; in the United States, it is estimated that up to 10% of nursing home admissions are attributable solely to urinary incontinence, reflecting both the functional impairment it produces and the difficulty families may have in managing the condition at home.[27] Such figures underscore the broader societal and economic implications of MUI.

Accurate characterization of urinary incontinence type is essential for effective management. In many cases, a carefully obtained clinical history is sufficient to distinguish between stress, urge, and mixed patterns, especially when patients are encouraged to describe the circumstances surrounding leakage episodes in detail.[28][29][30][31][32][33] Nonetheless, noninvasive diagnostic evaluations are strongly recommended to corroborate and refine the clinical impression, exclude reversible or contributory factors, and guide targeted therapy. These include urinalysis to detect infection, hematuria, or glycosuria; measurement of postvoid residual urine volume to identify significant urinary retention; and a focused pelvic examination in women to assess for pelvic organ prolapse, atrophic changes, or other structural abnormalities.[28][29][30][31][32][33] In selected patients, additional assessments such as bladder diaries, pad tests, or urodynamic studies may further delineate symptom patterns and underlying dysfunction. Management of MUI and other forms of urinary incontinence has evolved substantially, with a

broad spectrum of behavioral, pharmacologic, and surgical options now available to ameliorate symptoms and improve quality of life.[1][34] Treatment typically begins with conservative, noninvasive measures that address modifiable risk factors and reinforce pelvic floor function. These first-line strategies include lifestyle modifications (such as weight optimization and fluid and caffeine management), pelvic floor muscle training (Kegel exercises), topical vaginal estrogen therapy in appropriate women, structured physical therapy, and oral pharmacologic agents aimed primarily at the urge component of incontinence.[35][36] The choice and sequence of these interventions are individualized based on the relative prominence of stress and urge symptoms, comorbidities, patient preferences, and therapeutic response. When conservative measures fail to provide adequate relief or are insufficient to meet the patient's functional goals, more invasive options—including advanced neuromodulation techniques, bulking agents, and various surgical procedures—may be considered.[1][34][35][36] In all cases, a patient-centered, shared decision-making approach is essential, given the intimate nature of symptoms, the diversity of treatment options, and the need to balance efficacy with potential risks and lifestyle implications.

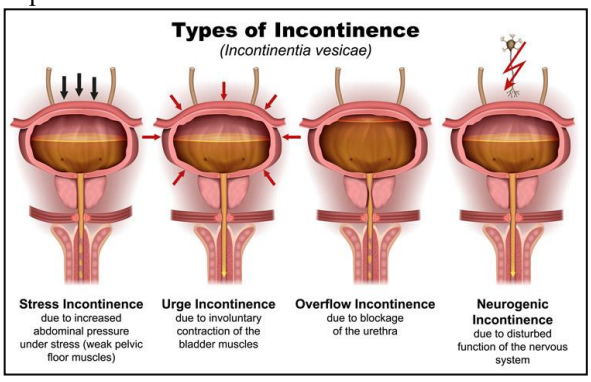

Fig. 1: Types of Urinary Incontinence.

Etiology

Mixed urinary incontinence (MUI) arises from a complex interaction of anatomic, neuromuscular, and functional factors that together disrupt normal lower urinary tract function. One of the most important contributors in women is advanced pelvic organ prolapse. A strong association between MUI and higher grades of pelvic organ prolapse has been demonstrated by studies showing that restoration of normal pelvic anatomy through vaginal reconstructive surgery results in resolution of urinary incontinence in more than half of women who present with concomitant MUI.[6] This observation underscores the central role of structural support in maintaining continence and highlights how prolapse-related distortion of pelvic anatomy can precipitate both stress and urge components of incontinence. Pelvic organ prolapse, particularly when severe, may cause mechanical obstruction of the bladder outlet. This obstruction leads to chronic overdistension of the bladder and subsequent detrusor muscle injury. Prolonged overfilling and elevated intravesical pressure can compromise blood flow to the detrusor, resulting in ischemia and tissue hypoxia.[37] Over time, these insults can induce neuropathic changes within the detrusor muscle, including degeneration of neural elements and remodeling of smooth muscle architecture. As the bladder wall becomes overstretched, an important series of pathophysiologic events occurs: the detrusor develops an exaggerated response to neurotransmitters despite a reduction in the number of functional contracting muscle fibers, and there is diminished efficiency in the spread of action potentials across the detrusor syncytium.[38][39][40] These changes impair coordinated contraction and lead to a loss of synchronous detrusor activity. The net result is an unstable, hyperresponsive bladder that is prone to involuntary contractions, clinically manifesting as urgency and urge incontinence, which form one component of MUI.

At the same time, weakness and disruption of the supportive structures of the urethra and bladder neck contribute significantly to the stress incontinence element of MUI. The endopelvic fascia, levator ani muscles, and associated connective tissues form a supportive "hammock" that maintains urethral alignment and appropriate closure pressure during periods of increased intraabdominal pressure. When the endopelvic fascia becomes attenuated or damaged, whether from childbirth trauma, aging, hormonal changes, or prior pelvic surgery, several biomechanical consequences ensue. These include urethral hypermobility, distortion or malposition of the urethra and bladder neck, diminished urethral tension and resistance, and loss of optimal bladder positioning within the pelvis.[6][41] Under these circumstances, rises in intraabdominal pressure are no longer effectively countered by an increase in urethral closing pressure, resulting in involuntary urine leakage during exertional activities such as coughing, sneezing, lifting, or exercise. This mechanism accounts for the stress component of MUI. Beyond these structural and neuromuscular factors, urinary incontinence in general—and MUI in particular—may coexist with or be influenced by a variety of other genitourinary and systemic conditions. Genitourinary causes include fistulous communications between the urinary tract and adjacent organs, congenital anomalies, chronic or recurrent infections, and overflow incontinence. Overflow incontinence refers to involuntary leakage due to chronic bladder overdistension, typically resulting from bladder outlet obstruction or impaired detrusor contractility. Common etiologies of reduced contractility include neurogenic conditions such as spinal cord injury and multiple sclerosis, as well as long-standing diabetic neuropathy, all of which

compromise detrusor function and limit effective emptying.[2] Over time, persistent high postvoid residual volumes further stretch the bladder and may aggravate existing detrusor instability.

Nongenitourinary contributors to incontinence are also clinically relevant and can modulate the expression of MUI. Functional incontinence, for example, arises when individuals are unable to reach the toilet in a timely fashion due to mobility limitations, environmental barriers, cognitive impairment, or logistical challenges, rather than primary dysfunction of the lower urinary tract.[2] Pharmacologic agents, including diuretics, sedatives, anticholinergics, and alpha-blockers, can exacerbate urgency, frequency, or sphincter incompetence, thereby worsening mixed symptoms. Metabolic disturbances such as poorly controlled diabetes or hypercalcemia may increase urine output or irritative voiding symptoms, further complicating the clinical picture. Thus, the etiology of MUI is rarely singular. Instead, it typically reflects the convergence of pelvic support failure, detrusor overactivity related to obstruction and ischemic neuropathy, and patient-specific factors such as neurologic status, comorbid disease, medications, and functional capacity. Understanding these overlapping mechanisms is crucial for targeted evaluation and personalized treatment, as effective management often requires addressing both the structural and functional components that underlie mixed urinary incontinence.[2][6][37][38][39][40][41]

Mixed Urinary Incontinence Risk Factors

Mixed urinary incontinence (MUI) arises from a constellation of interacting biological, anatomical, neurological, and lifestyle factors that collectively disturb the normal mechanisms of continence. While no single risk factor is solely responsible for its development, numerous conditions and exposures have been consistently associated with an elevated likelihood of experiencing combined stress and urge urinary symptoms. One of the most prominent contributors is advanced age. Aging is accompanied by progressive weakening of pelvic floor musculature, reduced estrogen levels in women, diminished bladder capacity, and alterations in detrusor contractility, all of which predispose the lower urinary tract to both stress-induced leakage and urgency-related dysfunction. As age increases, so does the prevalence of comorbidities that further compound continence mechanisms. A wide range of chronic medical conditions has been implicated as risk enhancers for MUI. Disorders such as diabetes mellitus, stroke, multiple sclerosis, neuropathies, and hydrocephalus may directly impair neural control of the bladder or pelvic floor, thereby contributing to urge-dominant symptoms or overflow phenomena. Similarly, psychiatric and cognitive comorbidities, including depression and cognitive impairment, affect a patient's ability to perceive bladder cues and respond appropriately, while conditions such as atrophic vaginitis, recurrent urinary tract infections, fecal incontinence, and interstitial cystitis contribute to chronic irritation or inflammation, aggravating urge incontinence symptoms.[23][42][43][44][45][46][47] A history of childhood enuresis may also signify underlying developmental or neurologic predispositions that persist into adulthood. Structural or congenital factors further influence risk. Ectopic ureters, although uncommon, can lead to continuous leakage that complicates the diagnosis and management of MUI. Multiparity, especially following vaginal deliveries, is strongly associated with pelvic floor weakening, urethral hypermobility, and ligamentous laxity, increasing vulnerability to stress incontinence while also predisposing to detrusor overactivity. Prior pelvic surgeries, including hysterectomy and transurethral resection of the prostate, may disrupt the anatomical or neurologic integrity of the continence apparatus, leading to mixed symptom presentation. Pelvic radiation carries similar risks by inducing fibrosis, reduced compliance, and neurovascular injury.

Lifestyle and environmental factors also play an important role. High-impact physical activities such as running and jumping exert repetitive stress on the pelvic floor, accelerating muscle fatigue and increasing the likelihood of stress-related leakage. Obesity amplifies intraabdominal pressure chronically, overwhelming urethral support mechanisms and impairing detrusor stability. Smoking, through chronic cough, vascular impairment, and pelvic tissue degradation, further compounds these risks. Residence in nursing homes is another notable risk factor, not because of intrinsic bladder dysfunction alone, but due to mobility limitations, inadequate toileting access, polypharmacy, and higher comorbidity burdens typical of institutionalized populations. Genetic and familial predispositions have also been recognized. A family history of urinary incontinence may reflect inherited tissue characteristics, collagen composition abnormalities, or patterns of neuromuscular function that predispose individuals to both stress and urge components of MUI. Taken together, these risk factors highlight the multifactorial nature of mixed urinary incontinence and underscore the importance of comprehensive patient evaluation to identify contributing elements and guide personalized management strategies.[23][42][43][44][45][46][47]

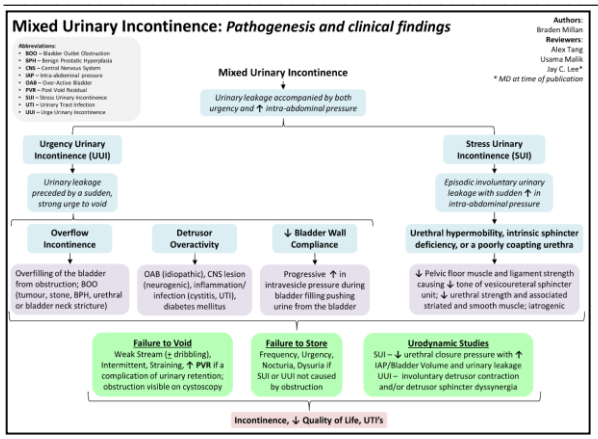

Fig. 2: Mixed Urinary Incontinence pathogenesis and outcomes.

Epidemiology

The epidemiology of mixed urinary incontinence (MUI) reflects not only its biological prevalence but also the profound underreporting that characterizes urinary symptoms across all age groups. Because many individuals experience embarrassment, stigma, or a belief that incontinence is an unavoidable part of aging or athletic activity, a substantial proportion of affected patients do not disclose their symptoms. As a result, the true prevalence of urinary incontinence is almost certainly higher than published estimates suggest.[23] Current data indicate that urinary incontinence affects between 25% and 45% of all adult women in the United States, making it one of the most common chronic health conditions in women.[2] Even among younger populations, the burden is striking. More than 25% of teenage and college-aged female athletes report stress or mixed urinary leakage, yet more than 90% of them do not share this information with their primary clinicians, illustrating the continued influence of social barriers and the normalization of symptoms in competitive settings. In older adults, the prevalence increases dramatically as age-related changes in neuromuscular function, hormonal status, mobility, and comorbid health conditions become more prominent. Among homebound older individuals, urinary incontinence affects approximately 53% of the population.[2] This high prevalence reflects not only physiologic vulnerability but also environmental limitations, reduced physical strength, polypharmacy, and delayed access to toileting, all of which increase the likelihood of both urgency-related and functional incontinence. Within nursing home settings, urinary incontinence is an even more pervasive issue. Although only about 6% of nursing home admissions are attributed directly to incontinence, more than half of residents experience regular urinary leakage.[48] These figures underscore how incontinence contributes to institutionalization, caregiver burden, and diminished quality of life in geriatric populations. Urinary incontinence is significantly more common in women, occurring at roughly twice the rate observed in men due to structural, obstetric, hormonal, and anatomical factors. Among women with substantial pelvic organ prolapse, the relationship is particularly strong; more than 33% of these women are found to have MUI, highlighting how pelvic support defects frequently manifest with combined stress and urge symptoms.[48][49] The economic burden of urinary incontinence is substantial. In the United States alone, the annual direct and indirect costs of medical and surgical treatment exceed $10 billion, reflecting not only healthcare expenditures but also lost productivity, caregiving costs, and reduced workforce participation.[50]

Globally, urinary incontinence represents a major public health issue, affecting an estimated 423 million individuals aged 20 years and older.[51] This global prevalence highlights the universal nature of the condition, transcending geographic, socioeconomic, and cultural boundaries. Within this broad spectrum, the distribution of the various types of chronic urinary incontinence can be delineated. Functional urinary incontinence, which arises from mobility or environmental limitations rather than intrinsic bladder dysfunction, has an uncertain but clinically significant prevalence. Mixed urinary incontinence accounts for approximately 20% to 30% of cases. Overflow incontinence is comparatively less common, representing about 5% of chronic incontinence presentations. Stress urinary incontinence remains predominant in women, affecting 24% to 45% of females older than 30 years.[52] Urge urinary incontinence demonstrates marked age- and sex-related differences. Approximately 9% of women aged 40 to 44 years' experience urge incontinence, but the prevalence rises substantially with age. Among men older than 75 years, urge incontinence occurs in roughly 42%, reflecting age-related prostate and neurologic changes. Women older than 75 years' experience urge incontinence at a rate of approximately 31%.[52] Collectively, these epidemiologic trends emphasize that urinary incontinence, particularly MUI, is a widespread and multifactorial condition that affects individuals across the lifespan, with profound implications for public health, healthcare systems, and quality of life.

Pathophysiology

The pathophysiology of mixed urinary incontinence (MUI) reflects the convergence of the mechanisms underlying both stress and urge urinary incontinence, resulting in a clinical presentation that incorporates features of each disorder. The stress incontinence component arises primarily from impairment of the structural and functional integrity of the pelvic floor. Normally, continence is preserved during periods of increased intraabdominal pressure through coordinated support of the urethra, bladder neck, and surrounding connective tissues. Weakness of the pelvic floor musculature, attenuation of the endopelvic fascia, prolapse of pelvic organs, or

disruption of normal urethrovesical alignment can undermine these compensatory mechanisms. In particular, the posterior urethrovesical angle, which should remain less than 120 degrees during straining, becomes altered when pelvic support is compromised.[3] As this angle widens, the urethra becomes hypermobile and less capable of generating adequate closure pressure during episodes of coughing, lifting, sneezing, or other exertional activities. Another essential contributor is intrinsic sphincter deficiency, in which the urethral sphincter fails to achieve or maintain complete closure, often due to loss of mucosal coaptation, vascular atrophy, or neuromuscular dysfunction. This further diminishes urethral resistance and predisposes involuntary leakage under stress conditions.[3] In contrast, the urge incontinence component of MUI is defined by involuntary bladder contractions that occur in the absence of voluntary control. These contractions, driven by detrusor overactivity, can be spontaneous or triggered by various sensory or mechanical stimuli. Patients often report precipitous urinary urgency, frequently provoked by positional changes such as rising from a supine to an upright posture, or by external sensory cues such as the sound of running water, hand washing, or exposure to cold air.[4] The physiologic substrate for these uninhibited contractions includes impaired neural regulation of bladder activity, heightened detrusor sensitivity, and reduced bladder compliance. Normally, the bladder maintains low pressure during filling through tightly regulated neural pathways involving the pontine micturition center, sacral spinal cord reflex arcs, and peripheral afferent and efferent fibers. Disruption at any of these levels can diminish inhibitory control, allowing premature or exaggerated detrusor contractions.

Multiple clinical conditions can precipitate or exacerbate urge incontinence by affecting bladder neurophysiology. Neurologic disorders such as multiple sclerosis, stroke, Parkinson disease, spinal cord injuries, and peripheral neuropathies are well-known contributors.[4][53][54] Pelvic radiation may induce fibrosis, vascular injury, and sensory dysfunction within the bladder wall, leading to reduced compliance and hypersensitivity. Alterations in the bladder microbiome, increasingly recognized as a component of lower urinary tract health, may also influence detrusor stability and inflammatory signaling, creating a more irritable bladder environment.[55] Likewise, prolonged Foley catheterization disrupts normal bladder cycling and sensory input, which can result in long-term detrusor overactivity.[56] In many patients, however, urge incontinence arises without an identifiable structural or neurologic cause, representing an idiopathic form of detrusor overactivity.[57] The interplay of these mechanisms produces the characteristic mixed symptom profile seen in MUI. Pelvic floor compromise reduces urethral resistance during stress events, while concurrent detrusor instability generates unpredictable urges and involuntary contractions. This dual dysfunction magnifies the clinical impact of each component, often making MUI more challenging to diagnose and manage than isolated stress or urge incontinence. For detailed discussion of these underlying mechanisms, refer to the StatPearls companion chapters “Urge Incontinence” and “Stress Incontinence.”

History and Physical

Clinical History

A comprehensive and carefully structured clinical history is fundamental to the diagnosis of mixed urinary incontinence (MUI). Because many individuals feel embarrassed or reluctant to initiate discussion about urinary symptoms, it is the responsibility of the clinician to create a supportive environment and ask direct, open-ended questions. Inquiries should focus on symptoms such as urinary frequency, urgency, hesitancy, slow or intermittent stream, straining during voiding, sensations of incomplete bladder emptying, dysuria, or involuntary leakage that may require the use of pads or result in visible wetness of clothing.[2] These symptoms often overlap among various forms of urinary incontinence, making a detailed exploration essential for distinguishing the mixed phenotype. A thorough past medical, surgical, and obstetric history is equally important in guiding diagnosis. Prior pelvic or urologic surgeries, childbirth trauma, hysterectomy, pelvic organ prolapse repairs, or neurologic injuries may significantly influence the underlying mechanisms of continence dysfunction.[2] Information regarding the onset and duration of urinary leakage, precipitants of symptoms, frequency of leakage episodes, voiding patterns, the approximate volume of leakage, pad usage, fluid intake habits, nocturia, and circumstances surrounding urgency events helps clarify whether stress or urge symptoms predominate.[2][4] Documentation of caffeine consumption is essential, as caffeine is a known bladder stimulant that can exacerbate urgency and frequency symptoms.[2][4] Validated symptom questionnaires—such as the International Consultation on Incontinence Questionnaire (ICIQ) or the Overactive Bladder Questionnaire (OAB-q)—may be used to quantify symptom severity and assess the impact of incontinence on daily functioning. Clinicians should also review comorbidities and contributing factors including diabetes, neurologic disease, constipation, chronic cough, mobility limitations, obesity, and psychiatric conditions, as these often modulate the expression of MUI. Medication review is critical, particularly for drugs that influence bladder dynamics such as diuretics, cholinergic agents, sedatives, anticholinergics, and alpha-blockers. In women, perimenopausal and postmenopausal estrogen

deficiency is a significant factor, and the clinician should discuss the potential benefit of topical vaginal estrogen therapy for improving urethral mucosal health and reducing irritative symptoms.[58] A voiding diary provides objective insight into bladder habits and incontinence patterns. A 24-hour diary documenting fluid intake, voided volumes, timing of leakage episodes, nocturnal voids, and activities associated with leakage offers valuable data.[31][32][33][59] Although a three-day diary is ideal for capturing variability, even a one-day record can meaningfully contribute to diagnosis and treatment planning.

Physical Examination

The physical examination in patients with MUI aims to identify findings consistent with both stress and urge mechanisms. Evaluation focuses primarily on the abdomen, pelvis, perineum, and, when appropriate, the neurologic system. Observations should include abdominal contour, the presence of a large panniculus, scars from prior surgeries, suprapubic tenderness, and pelvic floor muscle tone. Examination should be performed initially with a full bladder and then repeated after voiding, both in the supine and standing positions, to evaluate positional effects on urinary leakage.[2] In women, inspection and palpation of the pelvic floor structures are essential. The clinician should assess for pelvic organ prolapse, grading uterine or vaginal descent and identifying cystocele, rectocele, or enterocele, as these can alter urethral support and bladder dynamics. Provocative maneuvers such as coughing or Valsalva should be performed to elicit visible leakage and evaluate stress incontinence.[1] Atrophic changes, urethral hypermobility, or pelvic floor muscle weakness should also be noted. In men, a digital rectal examination allows assessment of sphincter tone and prostate size, both of which influence bladder outflow and continence. One of the standard diagnostic tools for confirming stress urinary incontinence is the cough stress test. In this procedure, the clinician instills 250 to 300 mL of sterile fluid into the bladder via catheter. Following removal of the catheter, the patient is instructed to cough forcefully. If leakage is not observed in the supine position, the test is repeated with the patient standing to increase sensitivity.[59] The cough stress test carries a high positive predictive value—approximately 78% to 97%—making it a reliable indicator of stress incontinence when positive.[60][61] However, a negative result must be interpreted cautiously, as inadequate bladder volume, patient inhibition due to embarrassment, or anxiety-induced pelvic floor tightening may minimize leakage. Together, a detailed clinical history and targeted physical examination provide the cornerstone for diagnosing MUI, enabling clinicians to distinguish stress from urge components, identify contributing factors, and formulate an individualized and effective management strategy.

Evaluation

The evaluation of mixed urinary incontinence (MUI) begins with structured, office-based diagnostic testing designed to distinguish among the different types of urinary incontinence and to identify coexisting conditions that may influence management. Simple, noninvasive assessments are often sufficient to characterize the predominant components of stress and urge incontinence and to determine whether additional specialized testing is needed.[28][29][30][31][32][33] Urinalysis, with or without urine culture, is a fundamental first step. This test is essential for excluding urinary tract infection, hematuria, glycosuria, and other abnormalities that may contribute to or mimic incontinence, such as acute cystitis or irritative voiding symptoms.[28] In the presence of infection, urgency and frequency may be prominent, and symptoms should be reassessed after appropriate antimicrobial treatment. Postvoid residual (PVR) urine volume measurement is another key component of initial evaluation. This can be performed using bladder ultrasound or catheterization shortly after spontaneous voiding. An elevated PVR suggests incomplete bladder emptying and may indicate overflow incontinence or significant detrusor underactivity.[28][62] Interestingly, approximately 20% of women with overactive bladder symptoms have elevated PVR volumes, underscoring that urgency and frequency are not exclusive to patients with normal emptying.[63] Risk factors for increased PVR include age 55 years or older, previous incontinence surgery, more severe and numerous urinary symptoms, multiple sclerosis, vaginal prolapse, and a history of more than two vaginal deliveries.[63] A voiding diary represents an invaluable tool for objectively documenting the pattern and severity of incontinence. Patients are asked to record, over 24 hours or preferably 3 days, the timing and volume of each void, fluid intake, episodes of urgency, and leakage events, including the circumstances surrounding them.[29][31][32][33][64][65][66][67] These records help quantify urgency, nocturia, and total urine output, and they clarify whether leakage is more closely associated with physical exertion, urgency, or both. Even a single-day diary can provide meaningful insights, although longer recordings better capture day-to-day variability.

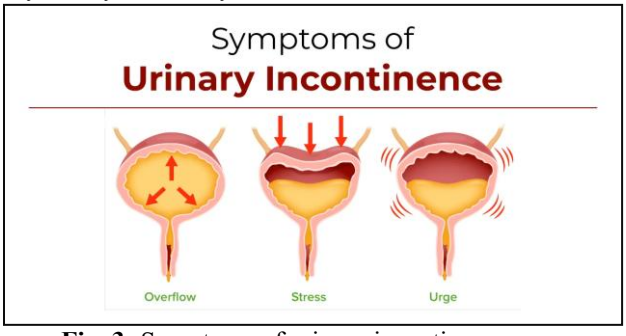

Fig. 3: Symptoms of urinary incontinence.

The cough stress test is a simple, office-based maneuver that is highly informative for diagnosing stress incontinence. After confirming a reasonably full bladder—either naturally or by instilling 250 to 300 mL of fluid via catheter—the catheter is removed and the patient is asked to cough forcefully in the supine position.[29][68] If no leakage is observed, the test is repeated in the standing position, where gravitational effects and abdominal pressure are greater. Visible leakage coincident with coughing is strongly suggestive of stress incontinence and thus supports the diagnosis of a stress component within MUI. The predictive value of a positive cough stress test is high, with reported positive predictive values ranging from 78% to 97%.[60][61] A negative result, however, is less definitive, as inadequate bladder volume, patient inhibition, or anxiety may mask leakage. Pelvic examination is particularly important in women and must be performed systematically. The clinician should assess for pelvic organ prolapse, vaginal atrophy, pelvic floor muscle tone, and urethral mobility. Prolapse can sometimes mask or diminish incontinence by kinking the urethra; therefore, the examination should include manual reduction of prolapse (elevating the vaginal walls or uterus to their expected anatomic position) followed by repeat assessment of leakage with a cough or Valsalva maneuver.[29] The strength and coordination of the levator ani muscles should be evaluated, as these are central to pelvic floor support and urethral closure.[29] In men, rectal examination allows assessment of anal sphincter tone and prostate size, which are relevant to outlet obstruction and bladder function. The Q-tip test is a more focused assessment of urethral hypermobility. A lubricated cotton-tipped swab is gently inserted through the urethra until it reaches the bladder neck, then withdrawn slightly to rest within the urethra. The patient is asked to perform a Valsalva maneuver, and the angle of deflection of the swab relative to the horizontal plane is measured. A urethral axis change of 30 degrees, or more is considered indicative of urethral hypermobility, supporting a diagnosis of stress incontinence due to deficient urethral support.[29][30][69][70]

Because neurogenic dysfunction is a recognized contributor to urge incontinence and may influence treatment, all patients with urinary incontinence should undergo a basic neurologic evaluation. This should include assessment of lower extremity strength and reflexes, perineal sensation, anal sphincter tone, and, when indicated, a focused evaluation for signs of central or peripheral nervous system disease. Identification of a neurologic disorder may prompt referral for specialist evaluation and influence subsequent diagnostic testing and therapeutic choices. Transperineal or translabial ultrasound has emerged as a valuable imaging modality in the evaluation of women with MUI, especially when a significant stress component is suspected.[71] Ultrasound can be used to visualize the posterior urethral angle, urethral inclination, and the degree of bladder neck descent both at rest and during Valsalva or coughing.[71][72] It also allows measurement of the distance between the pubic bone, urethra, and bladder neck, and can help characterize urethral mobility and pelvic floor support.[71][72] Studies have demonstrated that women with MUI and predominant urgency symptoms tend to have thicker bladder walls, possibly reflecting chronic detrusor overactivity, whereas women with balanced urge and stress components may exhibit greater bladder neck descent.[72] Ultrasound offers practical advantages over urodynamics in many settings, as it is faster, better tolerated, noninvasive, and free of radiation exposure.[71] When initial office-based tests do not provide a complete explanation for the patient's symptoms, or when red flags suggesting more complex pathology are present, additional diagnostic studies may be warranted. These can include cystoscopy to evaluate for intravesical pathology such as tumors, stones, diverticula, or foreign bodies; formal multi-channel urodynamic testing to assess bladder and urethral function under controlled conditions; and video-urodynamic studies, which combine fluoroscopic imaging with pressure measurements to provide detailed anatomic and functional information.[29] Such advanced investigations are generally reserved for patients with atypical presentations, prior failed treatments, neurologic disease, or those being considered for invasive surgical procedures.

Specialized urodynamic testing is particularly important in complex or ambiguous cases of incontinence. Many experts consider MUI itself an indication for urodynamic evaluation, given the need to document both stress-related leakage and detrusor overactivity, and to distinguish true mixed incontinence from cough-induced detrusor contractions.[71][73][74] Urodynamic confirmation of MUI would demonstrate stress incontinence, characterized by leakage associated with increased abdominal pressure without a detrusor contraction, as well as involuntary detrusor contractions consistent with urge incontinence.[71] Multi-channel urodynamics is also indicated in several additional circumstances, including abnormal office cystometric findings; preoperative evaluation before invasive or complex anti-incontinence surgery; continuous or unpredictable leakage patterns; persistent diagnostic uncertainty despite a thorough initial workup; and a history of previous radical pelvic surgery.[73][75][76] Other indications include incontinence refractory to conservative or initial surgical therapy, known or suspected neurologic disease, lack of correlation between reported symptoms and physical findings, significant pelvic

organ prolapse, prior pelvic radiation, and previous failed incontinence operations.[73][75][76] In summary, the evaluation of MUI proceeds from simple, noninvasive office investigations to more sophisticated studies based on the complexity of presentation, response to initial therapies, and planned interventions. A methodical, stepwise approach that integrates history, physical examination, basic diagnostic tests, and selective use of urodynamics and imaging allows accurate characterization of the underlying pathophysiology and optimization of individualized treatment strategies.

Treatment / Management

The management of mixed urinary incontinence (MUI) is grounded in a stepwise, conservative-first philosophy that prioritizes symptom control, quality-of-life improvement, and minimization of treatment-related risk. Initial therapy typically emphasizes nonsurgical approaches such as bladder training, pelvic floor muscle rehabilitation, lifestyle modification, and selected pharmacologic interventions, with more invasive procedures reserved for patients who fail to respond adequately or whose symptoms remain unacceptably burdensome.[35][77][78][79][80][81][82][83][84][85][86][87] Because MUI incorporates both stress and urge components, treatment is often multidimensional and tailored to the dominant symptomatology. Importantly, many patients, particularly those with elevated operative risk, may find partial improvement and increased confidence acceptable even if complete continence is not achieved, so conservative strategies are always recommended as the starting point. Conservative therapy encompasses several modalities. Bladder training is generally regarded as the foundational intervention and is frequently combined with pelvic floor exercises and reduction in dietary bladder irritants such as caffeine.[71][88] Patients are instructed to void first thing in the morning and then to gradually extend the interval between voids based on their usual pattern, often documented in a voiding diary. The initial strategy may involve adding 10 to 15 minutes to the typical intervoid interval, and once that becomes tolerable, a further 10 to 15 minutes is added in a stepwise fashion until a target interval of approximately three to four hours between daytime voids is reached.[88][89] Additionally, patients are encouraged to delay micturition for at least five minutes after the onset of urgency and to progressively increase this delay as tolerated by increments of five to ten minutes. If an urge episode cannot be controlled, the patient voids and then resumes the prior schedule. Throughout this process, a voiding diary is maintained to monitor progress, document leakage episodes, and adjust the regimen. Bladder training typically requires six to twelve weeks of consistent adherence to yield meaningful clinical benefit and is most effective when paired with regular Kegel exercises and caffeine reduction. Scheduled or timed voiding regimens may be used as adjuncts, particularly in individuals with cognitive or functional limitations.[71][88][89]

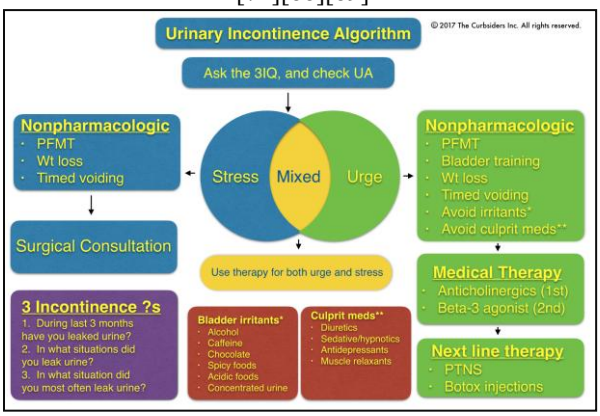

Fig. 4: Management of urinary incontinence.

An important adjunctive behavioral strategy is the so-called Knack technique, which is often delivered via a self-administered, story-based video program designed to train patients to anticipate high-risk situations for leakage and to perform preemptive pelvic floor muscle contractions at the critical moment.[90][91] By contracting the pelvic floor in anticipation of coughing, sneezing, or other stressors, the patient increases urethral closure pressure and counters the rise in intraabdominal pressure. Physiologically, this maneuver reduces stress incontinence by enhancing urethral resistance and dampening bladder excitability.[90][92][93][94] Furthermore, preemptive contractions can suppress detrusor overactivity, thereby attenuating urgency and urge incontinence.[90][94][95][96][97] In a randomized controlled trial, approximately 71% of participants reported significant improvement in incontinence using the Knack approach compared with only 21% in a group relying solely on dietary change and general exercise.[90] The Knack tutorial video is freely accessible online, making it a scalable and cost-effective educational resource for patients. Several additional noninvasive modalities have been developed to facilitate pelvic floor strengthening and modulate bladder activity. These include the use of vaginal cones to provide resistance training for pelvic muscles, intravaginal biofeedback devices that give patients visual or auditory feedback about contraction quality, percutaneous tibial nerve stimulation, and pelvic floor muscle therapy using direct vaginal electrical stimulation or extracorporeal magnetic innervation.[78][79][98][99][100][101][102][103][104][105] These therapies can enhance neuromuscular coordination and improve urethral support or reduce detrusor overactivity. However, in broad populations, their overall benefit may not substantially exceed that of properly taught and consistently performed bladder training and Kegel programs.[106] Evidence suggests that combination regimens—such as bladder training plus electrical stimulation with or without

biofeedback, or the addition of percutaneous tibial nerve stimulation—generally outperform single-modality treatments and may be particularly helpful in more refractory cases.[79][107][108][109]

Conservative strategies primarily aim to reduce symptom frequency and severity rather than to cure the condition. The urge component of MUI is often amenable to pharmacologic therapy. Antimuscarinic agents and beta-adrenergic agonists (such as those commonly used for overactive bladder) can reduce detrusor overactivity and urgency episodes.[4][110][111][112][113] Nonetheless, conservative measures have limitations. Their efficacy can be dependent on access to specialized training or equipment, and benefits may diminish once sessions or reinforcement end, especially if patients struggle with long-term adherence.[79] For refractory urgency and urge incontinence, more advanced options such as tibial nerve stimulation, intradetrusor injections of botulinum toxin A, or sacral neuromodulation may be considered, typically under specialist supervision.[4] These interventions modulate neural pathways that control bladder function and are reserved for individuals who have failed or cannot tolerate first-line pharmacologic therapy. For nocturnal enuresis or prominent nighttime leakage, external devices such as condom catheters for men or low-pressure vacuum wick systems for women can offer practical symptomatic relief and protect skin integrity, although they do not address the underlying pathophysiology.[114][115][116][117][118][119].

The stress incontinence component of MUI is often best managed surgically when conservative measures are insufficient, especially in the presence of significant pelvic organ prolapse. However, for some patients, particularly those who wish to avoid or delay surgery, a pessary may provide acceptable symptom control.[3][106] Pessaries are intravaginal devices that support the urethra and bladder neck, increase urethral length, and gently compress the urethra against the pubic bone, thereby augmenting urethral resistance and reducing stress-related leakage.[120][121][122][123][124][125][126] When correctly sized and fitted, pessaries are generally comfortable and unobtrusive. They must, however, be periodically removed and cleaned, and some patients may experience vaginal mucosal irritation, pain, bleeding, or increased risk of infection. Pessaries can also occasionally interfere with bowel movements. Despite these potential drawbacks, they remain a valuable minimally invasive option, particularly for those seeking reversible therapy or for whom surgery poses substantial risk. Optimal benefit requires meticulous fitting and ongoing follow-up.

Behavioral therapies broadly encompass interventions aimed at modifying habits that exacerbate MUI. These include structured biofeedback to improve awareness and control of pelvic floor muscles, bladder retraining protocols such as timed voiding, and dietary modifications that reduce intake of bladder irritants like alcohol, coffee, tea, caffeinated sodas, chocolate, and other methylxanthines.[127] Electrostimulation and extracorporeal magnetic innervation can be integrated into pelvic floor physical therapy programs to enhance muscle activation and endurance. Specialist pelvic floor physiotherapy remains a cornerstone of nonoperative care, providing individualized assessments and exercise regimens to improve muscle strength, coordination, and endurance [127]. When nonpharmacologic strategies are insufficient, medications become an important adjunct in the management of MUI. Several pharmacologic classes may be utilized, usually targeting the urge component. These include agents such as mirabegron and vibegron, which act on bladder receptors, anticholinergic drugs like oxybutynin, solifenacin, tolterodine, and trospium, which reduce detrusor contractility, and, in selected cases, calcium channel blockers such as amlodipine, nifedipine, and verapamil.[128][77][129][130] Estrogen therapy, primarily in the form of topical vaginal preparations, may be beneficial in women by improving urethral mucosal coaptation and vascularity, particularly in the setting of estrogen deficiency. Additionally, centrally acting agents such as selective serotonin and norepinephrine reuptake inhibitors (eg, duloxetine) and tricyclic antidepressants (eg, imipramine) have been employed to modulate sphincter function and sensory pathways.[128][77][129][130]

Duloxetine has been studied extensively and has demonstrated meaningful benefit in women with stress-predominant incontinence, likely through its ability to enhance urethral closing pressure by increasing serotonin and norepinephrine activity in the spinal cord.[131][132][133][134][135][136] In Europe, duloxetine is approved specifically for female stress urinary incontinence and has shown efficacy in clinical trials.[133][128][137] However, its use must be weighed against the risk of significant adverse effects, including mental health-related events, heightened suicidal ideation or behavior, and other systemic side effects.[133][137][138][139] In contrast, imipramine appears to confer only minimal benefit in most patients with MUI and is generally considered a secondary or adjunctive option.[131][132] Persistent nocturia that does not respond to standard incontinence measures may require additional evaluation and targeted therapy.[140] For nocturnal polyuria, desmopressin can reduce nighttime urine production, while adjusting the timing of diuretics such as furosemide to earlier in the day (approximately six hours before bedtime) can help limit overnight diuresis.[140] A more detailed review of such strategies is provided in the StatPearls “Nocturia” reference.(A1) For patients with persistent overactive bladder symptoms despite

standard medications, alternative therapies such as tibial nerve stimulation, intradetrusor botulinum toxin A injections, and sacral neuromodulation may provide significant relief.[4][141] Tibial nerve stimulation, performed percutaneously or transcutaneously, modulates sacral nerve activity via the posterior tibial nerve. Botulinum toxin A injections into the detrusor muscle decrease acetylcholine release at the neuromuscular junction, reducing involuntary contractions. Sacral neuromodulation involves the implantation of a device that delivers electrical impulses to the sacral nerves, thereby modulating bladder storage and voiding reflexes. These interventions are typically undertaken after urologic or urogynecologic referral and require careful patient selection and counseling. More detailed discussions can be found in StatPearls' "Urge Incontinence" and "Sacral Neuromodulation" chapters.[4][141]

Primary care clinicians are often well positioned to initiate MUI management with behavioral strategies, pelvic floor exercises, lifestyle adjustments, and pharmacologic therapy, provided that urinary retention, overflow incontinence, and active urinary tract infection have been ruled out. However, there are clear indications for referral to specialists such as urogynecologists or urologists.[142] Referral is appropriate when a surgical intervention is being contemplated, when conservative therapies fail to provide adequate symptom control, or when the clinical picture is complex. Situations warranting specialist assessment include the presence of abdominal or pelvic pain, hematuria not attributable to infection, suspected or established neurogenic bladder, significant comorbid neurologic conditions (eg, cerebral palsy, multiple sclerosis, spinal cord injury, Parkinson disease), symptomatic pelvic organ prolapse, prior failed incontinence surgeries, recurrent urinary tract infections, or uncertain diagnosis.[142] Patients being evaluated for sacral neuromodulation or other nerve stimulation therapies, those with pronounced stress incontinence requiring multiple pads per day, individuals with urinary retention or overflow, and those with documented voiding dysfunction such as elevated postvoid residual volumes should also be referred.[142] Additionally, cases involving suspected vesicovaginal fistula or those in which urodynamic studies are required for preoperative planning or diagnostic clarification are best managed in specialized centers. Surgical therapy becomes a central consideration when MUI is dominated by significant stress urinary incontinence, especially in the context of bothersome pelvic pressure and advanced pelvic organ prolapse. In such cases, surgical correction often provides the best opportunity for substantial and durable improvement. It is crucial to recognize, however, that surgery principally addresses the stress component; urgency and detrusor overactivity typically require concurrent or subsequent pharmacologic management.[3][6][143][144][145] Optimizing the overactive bladder symptoms before proceeding to surgery and ensuring that patients have realistic expectations regarding outcomes—understanding that urgency may persist—are important factors that influence satisfaction and perceived success. Surgical interventions generally seek to restore and reinforce the paraurethral connective tissues, pubourethral ligaments, and the supportive "hammock" of suburethral vaginal tissue in the mid-urethral region. Concurrent repair of cystocele, rectocele, uterine prolapse, or other pelvic support defects may be necessary to achieve anatomic and functional restoration.[143][144][145]

The mid-urethral sling procedure is considered the standard surgical approach for stress urinary incontinence and is widely used in women with or without MUI. A variety of abdominal and vaginal procedures exist, including the Marshall–Marchetti–Krantz suspension, Burch colposuspension, paravaginal repairs, various laparoscopic techniques, and older needle suspension procedures such as those described by Pereyra, Stamey, and Raz, in addition to different sling operations.[146][147] Many of these operations yield broadly comparable cure rates when used in appropriately selected patients.[146][147] Detailed descriptions of sling surgery and related procedures can be found in the StatPearls references on "Stress Incontinence" and "Pubovaginal Sling."[3][146] Likewise, separate StatPearls entries on "Cystocele," "Rectocele," "Pelvic Organ Prolapse," and "Uterine Prolapse" provide further insight into the surgical management of associated pelvic floor disorders.[143][144][145][148] Clinical experience suggests that more than half of women with significant pelvic organ prolapse experience marked improvement in urinary incontinence symptoms following prolapse repair, even in the absence of a concurrent sling, although adding a sling can enhance stress continence in selected patients.[6][149][150][151] Residual urgency can then often be effectively managed with anticholinergic or other overactive bladder medications. For stress incontinence, additional options include periurethral bulking agents, which are injected around the urethra to increase mucosal coaptation; adjustable continence therapy periurethral balloons; and, in severe or complex cases, artificial urinary sphincters.[3] While slings are an excellent option for isolated stress incontinence, patients with MUI and prominent preoperative urgency may be less satisfied because the surgery does not fully address the urge component and may not meet expectations for complete dryness.[152] Predictors of reduced satisfaction after stress incontinence surgery include significant preoperative overactive bladder symptoms, a long history of incontinence lasting more than 9.5 years, the need for preoperative

anticholinergic medication, diabetes mellitus, and unrealistic patient expectations [152].

Adjustable continence therapy devices represent an intermediate surgical option for stress incontinence. These systems employ implantable periurethral balloons placed at the level of the bladder neck.[153][154] A special trocar is used to create a tunnel for balloon placement, and each balloon is connected to an adjustment port implanted in the scrotum or beneath the skin, allowing percutaneous volume adjustments over time.[153][154] In patients where standard trocar tunneling is not feasible or safe, an open perineal approach has been described.[154][155] Reported outcomes are generally favorable, with continence rates exceeding 50% in appropriately selected individuals.[153][154][155][156][157][158] The procedure is technically simpler and usually less expensive than artificial sphincter implantation. These devices exert a static compressive effect on the urethra, but the degree of compression can be modified in the office, permitting individualized titration of urethral resistance. Success rates are comparable to those observed with artificial urinary sphincters, yet the operation is less invasive and recovery is typically quicker.[154][159][160][161][162][163]. Despite these advantages, adjustable continence therapy devices remain underutilized, particularly considering their potential as a less invasive alternative to artificial sphincters in both sexes.[154][158] In the United States, regulatory approval has been limited to use in men, even though studies show efficacy in women as well.[154][164][165] More detailed guidance regarding these devices is available in the StatPearls chapter on “Artificial Urinary Sphincters and Adjustable Dual-Balloon Continence Therapy in Men.” [154] Artificial urinary sphincters represent a more complex and definitive surgical solution for severe or refractory stress incontinence. FDA-approved for use in both men and women, they are particularly indicated in cases of neurogenic stress incontinence and persistent leakage following previous surgery.[166] Given the complexity of implantation and the availability of less invasive alternatives, artificial sphincters are generally reserved as a last-resort therapy for patients whose incontinence is not amenable to other treatments. Nevertheless, outcomes in this highly selected population are favorable, with good functional results reported even in older women over 75 years with otherwise intractable stress incontinence.[167][168][169][170][171][172] Unlike fixed sling or suspension procedures, artificial sphincters can dynamically alter urethral resistance—allowing high closure pressures at rest to maintain continence and transiently lowering resistance during voiding—making them especially suitable for patients with significant detrusor weakness who cannot generate strong voluntary contractions [166].

Complications associated with artificial urinary sphincters include urethral atrophy, cuff or device erosion, mechanical failure, fibrosis, and infection.[173] The cost of the device and the technical demands of implantation have historically limited widespread use. However, advances in laparoscopic and robotic techniques have contributed to reduced postoperative morbidity and may encourage broader adoption.[173][174][175] Ongoing innovations in device design and surgical approach are expected to improve durability, ease of use, and long-term outcomes.[176] Further information is provided in the StatPearls reference focusing on artificial urinary sphincters and adjustable dual-balloon therapy [154]. Intrinsic sphincter deficiency represents a particularly challenging form of stress incontinence characterized by profound loss of urethral closure pressure due to neuromuscular damage, scarring, or repeated surgery.[156][159][163][177][178][179][180] It may occur independently or in conjunction with urethral hypermobility. In these cases, incontinence can be severe, sometimes continuous, and even minor increases in intraabdominal pressure can provoke substantial leakage. Treatment generally parallels that of stress incontinence but is often less successful, and surgical results may be less durable. Mid-urethral slings are typically the preferred surgical option, but other sling types, bulking agents, adjustable periurethral balloons, and artificial urinary sphincters may also be considered.[156][159][163][177][178][179][180] In women with intrinsic sphincter deficiency, artificial sphincters may offer superior functional results compared with other surgeries, but this benefit must be weighed against higher rates of intraoperative and postoperative complications, increased operating time, greater susceptibility to device failure, and longer hospital stays.[181] In summary, the treatment and management of mixed urinary incontinence require a carefully individualized, multimodal strategy that starts with conservative therapies and escalates to pharmacologic, neuromodulatory, or surgical options as warranted. Optimal care depends on accurate characterization of the relative stress and urge components, thorough counseling regarding expectations and risks, and collaborative decision-making that aligns therapeutic choices with patient goals, comorbidities, and lifestyle.

Differential Diagnosis

The differential diagnosis of mixed urinary incontinence (MUI) is broad and encompasses a range of urologic, gynecologic, neurologic, and inflammatory conditions that can mimic or coexist with both stress and urge symptoms. A careful history, physical examination, and targeted investigations are therefore essential to distinguish

MUI from other disorders that may require distinct management strategies. Acute or chronic cystitis is one of the most common mimickers, as urinary urgency, frequency, and suprapubic discomfort may dominate the clinical picture. Recurrent urinary tract infections in males and females must be considered, particularly when irritative voiding symptoms are prominent. In men, benign prostatic hyperplasia and prostatitis are frequent causes of lower urinary tract symptoms and may result in obstructive voiding, incomplete emptying, and overflow leakage, which can be mistaken for or accompany MUI. Urinary obstruction more generally—whether due to urethral strictures, urethral scarring, or pelvic masses—should also be excluded. Pelvic floor and structural abnormalities such as cystocele, rectocele, and uterine prolapse can predispose to incontinence by altering bladder and urethral support, and may present with mixed symptomatology. Vaginitis and interstitial cystitis can produce pelvic discomfort, urgency, dyspareunia, and frequency, creating diagnostic confusion. Neurologic causes must be carefully evaluated, including multiple sclerosis, neurogenic bladder, spinal cord neoplasms, abscesses, or trauma, all of which can disrupt the neural pathways governing bladder storage and emptying. Radiation cystitis, following pelvic radiotherapy, may lead to chronic irritative symptoms and reduced bladder capacity, mimicking urge-predominant incontinence. Cough-induced detrusor overactivity should be differentiated from true mixed incontinence, as this phenomenon represents reflex detrusor contractions triggered by stress events rather than coexisting primary stress and urge pathologies. Pure urge incontinence must also be distinguished from MUI, especially when there is no demonstrable stress leakage on examination. A structured, stepwise evaluation that considers these entities—acute or chronic cystitis, benign prostatic hyperplasia, prostatitis, urethral strictures, urinary obstruction, interstitial cystitis, neurogenic bladder, spinal cord pathology, radiation cystitis, pelvic organ prolapse, vaginitis, and isolated urge incontinence—allows clinicians to refine the diagnosis and tailor therapy accordingly.[65][66]

Prognosis

The prognosis of mixed urinary incontinence depends on multiple factors, including the underlying etiology, the relative predominance of stress or urge components, the presence of pelvic organ prolapse, comorbid conditions, and the patient's treatment expectations. When a patient seeks complete resolution of stress urinary incontinence with no residual leakage, it is essential to provide detailed informed consent regarding surgical options, expected outcomes, and potential complications. Data suggest that both abdominal and vaginal surgical approaches offer broadly comparable success, with cure rates of approximately 86%, clinical improvement in about 7% of patients, and failure in another 7%.[147] A "clinical cure" in this context implies the absence of significant postoperative incontinence such that the patient does not require further treatment or urodynamic testing. Patients who achieve only partial improvement, characterized by occasional intermittent leakage, or those whose procedures fail to adequately address symptoms, may require further evaluation. In such situations, urodynamic testing is often necessary to distinguish between persistent stress incontinence, residual or emergent urge incontinence, or other subtypes and variations. Depending on the findings, additional behavioral therapy, pharmacologic treatment, or reoperation may be indicated. Reoperative surgery is generally considered a last resort due to increased risks and potentially lower success rates. Newer and more targeted interventions expand therapeutic possibilities for patients who have not responded to standard surgical or medical therapies. Periurethral bulking agents, adjustable continence device therapy, and artificial urinary sphincters can provide meaningful relief of stress symptoms in carefully selected men and women who have failed prior approaches.[3] For individuals with severe urgency and overactive bladder symptoms refractory to conventional pharmacologic management, sacral neuromodulation, intradetrusor botulinum A toxin injections, and tibial nerve stimulation offer additional options that can significantly improve bladder control and quality of life.[4][141] Overall, prognosis is generally favorable when patients are thoroughly evaluated, counseled realistically, and managed with a tailored, multimodal treatment plan.

Complications

Complications related to the management of mixed urinary incontinence are most frequently associated with surgical interventions for the stress component, although nonsurgical treatments may also have adverse effects. It is essential that the potential risks of surgery be clearly communicated to patients as part of preoperative counseling. Common surgical risks include bleeding and infection, which may present in the immediate postoperative period and require antibiotic therapy, wound care, or, rarely, reoperation. Injuries to adjacent structures of the genitourinary or gastrointestinal tract—such as the bladder, urethra, ureters, rectum, or bowel—although relatively uncommon, are serious complications that may necessitate prompt recognition and repair.[147] Persistent or recurrent urinary incontinence or pelvic organ prolapse is another important concern. Even after technically successful procedures, some patients may continue to experience bothersome leakage, often due to unaddressed or recurrent detrusor overactivity, intrinsic sphincter deficiency, or inadequate restoration of urethral support. Recurrence of prolapse can similarly undermine the durability of surgical correction. Postoperative dyspareunia is a further potential complication, especially after

vaginal procedures, which may result from scarring, tissue tension, or mesh-related issues when synthetic materials are used. This can significantly affect sexual function and overall satisfaction with surgery. Urethral erosion and mesh or sling complications are particularly important to discuss in procedures involving synthetic materials. Erosion into the urethra or vagina may lead to pain, recurrent infections, hematuria, and recurrent incontinence, often necessitating partial or complete removal of the device and, potentially, additional reconstructive surgery.[147] Beyond surgical risks, pharmacologic therapies for the urge component can cause side effects such as dry mouth, constipation, cognitive changes, or cardiovascular concerns, particularly in older or medically complex patients. Interventions such as botulinum toxin A injections carry a risk of urinary retention, sometimes requiring temporary catheterization, while neuromodulation procedures may entail lead migration, pain, or device malfunction. Thorough counseling, careful patient selection, and ongoing follow-up are therefore essential to minimize complications and optimize long-term outcomes [147].

Postoperative and Rehabilitation Care

Postoperative and rehabilitation care following surgical treatment for mixed urinary incontinence is critical to ensure optimal healing, functional recovery, and long-term success. Many patients require temporary bladder drainage after surgery, typically via a urethral or suprapubic catheter, to prevent acute urinary retention and allow the surgical site to stabilize. The duration of catheterization varies depending on the type of procedure and individual factors, but clinicians generally aim to resume spontaneous voiding as early as safely possible. Postvoid residual urine volumes should be monitored after catheter removal, with a target of less than 100 mL, as higher volumes may indicate persistent voiding dysfunction or obstruction. Fortunately, mild voiding difficulties that occur immediately after surgery often resolve spontaneously within days to weeks as tissue edema subsides and the pelvic floor adapts. Patients should receive clear guidance on activity restrictions during the early postoperative period. Sexual intercourse is typically contraindicated for at least six weeks, allowing adequate time for tissue healing, suture integration, and stabilization of any implanted materials. Resuming coital activity earlier may risk disruption of the surgical repair, increased pain, or complications such as bleeding and infection. Similarly, patients are generally advised to avoid heavy lifting, usually defined as lifting more than 25 pounds, during the same interval. Excessive increases in intraabdominal pressure during early healing can compromise surgical repair integrity, contribute to recurrent prolapse, or precipitate recurrent stress incontinence. Rehabilitation may also include pelvic floor physical therapy to optimize muscle strength, coordination, and flexibility, particularly in patients with preexisting pelvic floor dysfunction or those recovering from extensive prolapse repairs. Education on healthy bowel habits, prevention of constipation, and proper lifting mechanics is equally important to reduce strain on the pelvic floor. Follow-up visits should be scheduled to monitor wound healing, assess continence status, address pain or dyspareunia, and adjust any pharmacologic therapy for residual urgency or irritative symptoms. Early identification and management of complications, including urinary retention, infection, or erosion, can prevent more serious sequelae. Comprehensive postoperative care, combined with targeted rehabilitation efforts, enhances surgical durability and patient satisfaction [148].

Patient Education

Deterrence of mixed urinary incontinence and its complications relies heavily on patient education, public awareness, and clinician engagement. Providing accessible, evidence-based information enables patients to recognize early symptoms, seek timely evaluation, and understand the full range of available treatment options. Education should emphasize that urinary incontinence is a common, treatable medical condition rather than an inevitable or shameful consequence of aging or childbirth. By reducing stigma, patients may feel more comfortable discussing symptoms with healthcare providers and participating in shared decision-making. Reliable patient education resources are particularly valuable in reinforcing information delivered during office visits and supporting long-term adherence to behavioral strategies. Several reputable organizations offer free, high-quality educational materials on urinary incontinence and MUI. The American College of Obstetricians and Gynecologists provides patient-friendly information on urinary incontinence and women's health. The American Urological Association and the Urology Care Foundation offer educational content on urinary incontinence, treatment options, and self-care strategies. The National Association for Continence (NAFC) and The Simon Foundation for Continence provide comprehensive resources, including guides, support tools, and telephone assistance for patients and caregivers [149].

Additional resources are available through international and regional organizations. The European Association of Urology, the International Continence Society, and the International Urogynecological Association provide multilingual patient education materials and practical guidance on continence promotion. National health systems, such as the UK National Health Service, also host detailed patient information pages on urinary incontinence, while the Continence Foundation of Australia offers

region-specific education and support. Clinicians should routinely direct patients to these trusted sites and encourage them to involve family members or caregivers in the educational process. Empowering patients with knowledge about risk factors, preventive strategies (such as weight management, pelvic floor exercises, and avoidance of bladder irritants), and the importance of early intervention can reduce the burden of MUI, improve treatment adherence, and enhance overall outcomes. Education of healthcare professionals is equally important to ensure they remain current with evolving guidelines, therapeutic innovations, and best practices [149].

Other Issues

Several key principles can help clinicians navigate the complexities of managing mixed urinary incontinence. First, establishing realistic treatment expectations from the outset is essential. Patients should understand that while a complete cure is possible, especially for the stress component, treatment success is often defined as a meaningful reduction in symptom severity that improves quality of life rather than absolute dryness. Addressing the most bothersome symptoms first—usually urgency, frequency, and urgency incontinence—is often a practical strategy, as these are commonly responsive to pharmacologic and behavioral interventions. Although postvoid residual measurement is not strictly mandatory before initiating therapy, many experts recommend obtaining it at least once during evaluation to avoid missing overflow incontinence, particularly in older adults or those with neurologic disease. A 24-hour voiding diary, documenting void frequency, volumes, and leakage episodes, is extremely useful in complex cases and can help differentiate nocturnal polyuria, behavioral patterns, and mixed symptomatology.[65][66] When stress incontinence is prominent, a properly fitted pessary can offer immediate and reversible symptom relief. If the patient finds it unsatisfactory or uncomfortable, the device can simply be removed without lasting consequences, making it an attractive trial therapy. Adjustable continence devices and artificial urinary sphincters remain underutilized despite their efficacy in appropriately selected patients, particularly women with refractory stress incontinence or intrinsic sphincter deficiency. These options should be discussed during counseling alongside more conventional procedures so patients are aware of all available treatments. Innovations such as disposable, self-inserted intravaginal pessaries currently in clinical trials have shown promising results, with more than 87% of users reporting at least a 50% reduction in leakage and no serious adverse effects, suggesting a potential future role in conservative management of stress incontinence.[182] For nocturnal enuresis and nighttime leakage in women, low-pressure external vacuum wick incontinence systems can help maintain skin dryness, minimize irritation, and improve comfort, even though they do not correct the underlying pathology.[118][119] Similar devices, including male-specific pads or appropriately secured condom catheters, can be used in men.[118][119][183] These supportive products, used in conjunction with medical or surgical therapies, contribute significantly to symptom management and quality of life. Overall, a flexible, patient-centered approach that incorporates both established and emerging options is crucial in optimizing care.

Enhancing Healthcare Team Outcomes

Effective management of mixed urinary incontinence requires coordinated efforts from an interprofessional healthcare team. Because MUI is common in primary care settings, primary clinicians play a pivotal role in initial recognition, evaluation, and early management. A thorough history and physical examination provide the foundation for an accurate differential diagnosis, after which clinicians can initiate conservative treatments such as behavioral therapy, pelvic floor exercises, and first-line pharmacologic agents. It is essential to communicate clearly that not all treatment options result in complete resolution and that success is measured primarily by improvement in symptoms and quality of life, rather than absolute elimination of leakage. Ethically, clinicians are obligated to explain and offer the least invasive, evidence-based options before recommending surgical interventions. This includes lifestyle modification, bladder training, pelvic floor rehabilitation, and medications. When more complex therapy is required, referral to urogynecologists, urologists, physiatrists, or pelvic floor physical therapists becomes crucial. Advanced practice providers, including nurse practitioners and physician assistants, can assist in longitudinal monitoring, reinforcing behavioral strategies, managing medications, and providing patient education. Nurses are integral to every stage of care. They often conduct initial screenings, teach pelvic floor exercises, help patients maintain voiding diaries, and provide ongoing counseling. Pharmacists contribute by reviewing medication regimens for potential interactions or agents that may exacerbate incontinence, recommend appropriate pharmacologic options, and advising on side effect management. When neuromodulation, botulinum toxin injections, pessary fitting, or surgical procedures are considered, close communication between specialties is vital to ensure continuity of care and consistent messaging. Patient safety and satisfaction are optimized when all team members present a unified, patient-centered message, explaining the rationale for each intervention, expected outcomes, and possible alternatives. Regular multidisciplinary meetings or case conferences can help align treatment plans, particularly for complex or refractory cases. By fostering collaboration among physicians, advanced practitioners, nurses, pharmacists, physical therapists, and support staff, the healthcare team can deliver

comprehensive, coordinated care that enhances clinical outcomes, reduces complications, and improves the overall experience for patients living with mixed urinary incontinence [180][181][183].

Conclusion:

In conclusion, mixed urinary incontinence is a complex but manageable condition requiring a systematic and patient-tailored approach. Successful management hinges on accurately diagnosing the relative contributions of stress and urge components through a thorough clinical evaluation. Initial treatment should always prioritize conservative, non-invasive strategies, including structured bladder training, pelvic floor muscle rehabilitation (such as the Knack technique), and lifestyle modifications. Pharmacologic therapy primarily targets the urge component. When conservative measures are insufficient, particularly for the stress element, surgical options like the mid-urethral sling offer high success rates, though patients must be counseled that residual urgency may persist. Ultimately, optimal outcomes are achieved through a collaborative, interprofessional model of care that sets realistic goals, prioritizes patient education, and individualizes the treatment plan to improve quality of life and functional independence.

References:

1. ACOG Practice Bulletin No. 155: Urinary Incontinence in Women. Obstetrics and gynecology. 2015 Nov:126(5):e66-e81. doi: 10.1097/AOG.0000000000001148.
2. Tran LN, Puckett Y. Urinary Incontinence. StatPearls. 2024 Jan
3. Lugo T, Riggs J. Stress Incontinence. StatPearls. 2024 Jan
4. Nandy S, Ranganathan S. Urge Incontinence. StatPearls. 2024 Jan
5. Irwin DE, Milsom I, Chancellor MB, Kopp Z, Guan Z. Dynamic progression of overactive bladder and urinary incontinence symptoms: a systematic review. European urology. 2010 Oct:58(4):532-43. doi: 10.1016/j.eururo.2010.06.007.
6. Lo TS, Uy-Patrimonio MC, Kao CC, Chua S, Huang TX, Wu MP. Urodynamics mixed type urinary incontinence with advanced pelvic organ prolapse, management and outcomes. Scientific reports. 2020 Feb 6:10(1):1944. doi: 10.1038/s41598-020-58594-3.
7. Erekson EA, Cong X, Townsend MK, Ciarleglio MM. Ten-Year Prevalence and Incidence of Urinary Incontinence in Older Women: A Longitudinal Analysis of the Health and Retirement Study. Journal of the American Geriatrics Society. 2016 Jun:64(6):1274-80. doi: 10.1111/jgs.14088.
8. AlQuaiz AM, Kazi A, AlYousefi N, Alwatban L, AlHabib Y, Turkistani I. Urinary Incontinence Affects the Quality of Life and Increases Psychological Distress and Low Self-Esteem. Healthcare (Basel, Switzerland). 2023 Jun 15:11(12):. doi: 10.3390/healthcare11121772.
9. Huang P, Luo K, Wang C, Guo D, Wang S, Jiang Y, Huang W, Zhang W, Ding M, Wang J. Urinary Incontinence Is Associated With Increased All-Cause Mortality in Older Nursing Home Residents: A Meta-Analysis. Journal of nursing scholarship : an official publication of Sigma Theta Tau International Honor Society of Nursing. 2021 Sep:53(5):561-567. doi: 10.1111/jnu.12671.
10. Brown JS, Vittinghoff E, Wyman JF, Stone KL, Nevitt MC, Ensrud KE, Grady D. Urinary incontinence: does it increase risk for falls and fractures? Study of Osteoporotic Fractures Research Group. Journal of the American Geriatrics Society. 2000 Jul:48(7):721-5
11. Gibson W, Hunter KF, Camicioli R, Booth J, Skelton DA, Dumoulin C, Paul L, Wagg A. The association between lower urinary tract symptoms and falls: Forming a theoretical model for a research agenda. Neurourology and urodynamics. 2018 Jan:37(1):501-509. doi: 10.1002/nau.23295.
12. Schluter PJ, Askew DA, Jamieson HA, Arnold EP. Urinary and fecal incontinence are independently associated with falls risk among older women and men with complex needs: A national population study. Neurourology and urodynamics. 2020 Mar:39(3):945-953. doi: 10.1002/nau.24266.
13. Coyne KS, Sexton CC, Irwin DE, Kopp ZS, Kelleher CJ, Milsom I. The impact of overactive bladder, incontinence and other lower urinary tract symptoms on quality of life, work productivity, sexuality and emotional well-being in men and women: results from the EPIC study. BJU international. 2008 Jun:101(11):1388-95. doi: 10.1111/j.1464-410X.2008.07601.x.
14. Yip SK, Cardozo L. Psychological morbidity and female urinary incontinence. Best practice & research. Clinical obstetrics & gynaecology. 2007 Apr:21(2):321
15. Coyne KS, Wein AJ, Tubaro A, Sexton CC, Thompson CL, Kopp ZS, Aiyer LP. The burden of lower urinary tract symptoms: evaluating the effect of LUTS on health-related quality of life, anxiety and depression: EpiLUTS. BJU international. 2009 Apr:103 Suppl 3():4-11. doi: 10.1111/j.1464-410X.2009.08371.x.
16. Brown JS, McGhan WF, Chokroverty S. Comorbidities associated with overactive bladder. The American journal of managed care. 2000 Jul:6(11 Suppl):S574-9
17. Dubeau CE, Simon SE, Morris JN. The effect of urinary incontinence on quality of life in older nursing home residents. Journal of the American Geriatrics Society. 2006 Sep:54(9):1325-33

18. . Sexual satisfaction in the elderly female population: A special focus on women with gynecologic pathology. Maturitas. 2011 Nov:70(3):210-5. doi: 10.1016/j.maturitas.2011.07.015.
19. Barber MD, Visco AG, Wyman JF, Fantl JA, Bump RC, Continence Program for Women Research Group. Sexual function in women with urinary incontinence and pelvic organ prolapse. Obstetrics and gynecology. 2002 Feb:99(2):281-9
20. Gray T, Li W, Campbell P, Jha S, Radley S. Evaluation of coital incontinence by electronic questionnaire: prevalence, associations and outcomes in women attending a urogynaecology clinic. International urogynecology journal. 2018 Jul:29(7):969-978. doi: 10.1007/s00192-017-3380-x.
21. Munaganuru N, Van Den Eeden SK, Creasman J, Subak LL, Strano-Paul L, Huang AJ. Urine leakage during sexual activity among ethnically diverse, community-dwelling middle-aged and older women. American journal of obstetrics and gynecology. 2017 Oct:217(4):439.e1-439.e8. doi: 10.1016/j.ajog.2017.05.069.
22. Serati M, Salvatore S, Uccella S, Nappi RE, Bolis P. Female urinary incontinence during intercourse: a review on an understudied problem for women's sexuality. The journal of sexual medicine. 2009 Jan:6(1):40-8. doi: 10.1111/j.1743-6109.2008.01055.x.
23. Abrar S, Mohsin R, Samad A. Female Urinary Incontinence: Frequency, Risk Factors, and Impact on the Quality of Life of Pregnant Pakistani Women. Pakistan journal of medical sciences. 2023 May-Jun:39(3):667-671. doi: 10.12669/pjms.39.3.6313.
24. Schumpf LF, Theill N, Scheiner DA, Fink D, Riese F, Betschart C. Urinary incontinence and its association with functional physical and cognitive health among female nursing home residents in Switzerland. BMC geriatrics. 2017 Jan 13:17(1):17. doi: 10.1186/s12877-017-0414-7.
25. Gotoh M, Matsukawa Y, Yoshikawa Y, Funahashi Y, Kato M, Hattori R. Impact of urinary incontinence on the psychological burden of family caregivers. Neurourology and urodynamics. 2009:28(6):492-6. doi: 10.1002/nau.20675.
26. Bektas Akpinar N, Unal N, Akpinar C. Urinary Incontinence in Older Adults: Impact on Caregiver Burden. Journal of gerontological nursing. 2023 Apr:49(4):39-46. doi: 10.3928/00989134-20230310-01.
27. Morrison A, Levy R. Fraction of nursing home admissions attributable to urinary incontinence. Value in health : the journal of the International Society for Pharmacoeconomics and Outcomes Research. 2006 Jul-Aug:9(4):272-4
28. Ballstaedt L, Leslie SW, Woodbury B. Bladder Post Void Residual Volume. StatPearls. 2024 Jan
29. Pal M, Halder A, Bandyopadhyay S. Approach to a woman with urinary incontinence. Urology annals. 2020 Jan-Mar:12(1):4-8. doi: 10.4103/UA.UA_50_19.
30. Robledo D, Zuluaga L, Bravo-Balado A, Domínguez C, Trujillo CG, Caicedo JI, Rondón M, Azuero J, Plata M. Present value of the Urethral mobility test as a tool to assess Stress urinary incontinence due to Intrinsic sphincteric deficiency. Scientific reports. 2020 Dec 2:10(1):20993. doi: 10.1038/s41598-020-77493-1.
31. Bright E, Drake MJ, Abrams P. Urinary diaries: evidence for the development and validation of diary content, format, and duration. Neurourology and urodynamics. 2011 Mar:30(3):348-52. doi: 10.1002/nau.20994.
32. Bryan NP, Chapple CR. Frequency volume charts in the assessment and evaluation of treatment: how should we use them? European urology. 2004 Nov:46(5):636-40
33. Abrams P, Klevmark B. Frequency volume charts: an indispensable part of lower urinary tract assessment. Scandinavian journal of urology and nephrology. Supplementum. 1996:179():47-53
34. Brown HW, Guan W, Schmuhl NB, Smith PD, Whitehead WE, Rogers RG. If We Don't Ask, They Won't Tell: Screening for Urinary and Fecal Incontinence by Primary Care Providers. Journal of the American Board of Family Medicine : JABFM. 2018 Sep-Oct:31(5):774-782. doi: 10.3122/jabfm.2018.05.180045.
35. Game X, Dmochowski R, Robinson D. Mixed urinary incontinence: Are there effective treatments? Neurourology and urodynamics. 2023 Feb:42(2):401-408. doi: 10.1002/nau.25065.
36. Huang YC, Chang KV. Kegel Exercises. StatPearls. 2024 Jan
37. Azadzoi KM, Pontari M, Vlachiotis J, Siroky MB. Canine bladder blood flow and oxygenation: changes induced by filling, contraction and outlet obstruction. The Journal of urology. 1996 Apr:155(4):1459-65
38. Harrison SC, Ferguson DR, Doyle PT. Effect of bladder outflow obstruction on the innervation of the rabbit urinary bladder. British journal of urology. 1990 Oct:66(4):372-9
39. van Koeveringe GA, Mostwin JL, van Mastrigt R, van Koeveringe BJ. Effect of partial urethral obstruction on force development of the guinea pig bladder. Neurourology and urodynamics. 1993:12(6):555-66; discussion 566-71
40. Seki N, Karim OM, Mostwin JL. The effect of experimental urethral obstruction and its reversal on changes in passive electrical properties of

detrusor muscle. The Journal of urology. 1992 Dec:148(6):1957-61
41. DeLancey JO. Structural support of the urethra as it relates to stress urinary incontinence: the hammock hypothesis. American journal of obstetrics and gynecology. 1994 Jun:170(6):1713-20; discussion 1720-3
42. Lukacz ES, Lawrence JM, Contreras R, Nager CW, Luber KM. Parity, mode of delivery, and pelvic floor disorders. Obstetrics and gynecology. 2006 Jun:107(6):1253-60
43. Subak LL, Richter HE, Hunskaar S. Obesity and urinary incontinence: epidemiology and clinical research update. The Journal of urology. 2009 Dec:182(6 Suppl):S2-7. doi: 10.1016/j.juro.2009.08.071.
44. Hannestad YS, Lie RT, Rortveit G, Hunskaar S. Familial risk of urinary incontinence in women: population based cross sectional study. BMJ (Clinical research ed.). 2004 Oct 16:329(7471):889-91
45. Elia G, Bergman J, Dye TD. Familial incidence of urinary incontinence. American journal of obstetrics and gynecology. 2002 Jul:187(1):53-5
46. Subak LL, Wing R, West DS, Franklin F, Vittinghoff E, Creasman JM, Richter HE, Myers D, Burgio KL, Gorin AA, Macer J, Kusek JW, Grady D, PRIDE Investigators. Weight loss to treat urinary incontinence in overweight and obese women. The New England journal of medicine. 2009 Jan 29:360(5):481-90. doi: 10.1056/NEJMoa0806375.
47. Rortveit G, Hannestad YS, Daltveit AK, Hunskaar S. Age- and type-dependent effects of parity on urinary incontinence: the Norwegian EPINCONT study. Obstetrics and gynecology. 2001 Dec:98(6):1004-10
48. . Managing acute and chronic urinary incontinence. AHCPR Urinary Incontinence in Adults Guideline Update Panel. American family physician. 1996 Oct:54(5):1661-72
49. Dooley Y, Kenton K, Cao G, Luke A, Durazo-Arvizu R, Kramer H, Brubaker L. Urinary incontinence prevalence: results from the National Health and Nutrition Examination Survey. The Journal of urology. 2008 Feb:179(2):656-61
50. Carls C. The prevalence of stress urinary incontinence in high school and college-age female athletes in the midwest: implications for education and prevention. Urologic nursing. 2007 Feb:27(1):21-4, 39
51. Irwin DE, Kopp ZS, Agatep B, Milsom I, Abrams P. Worldwide prevalence estimates of lower urinary tract symptoms, overactive bladder, urinary incontinence and bladder outlet obstruction. BJU international. 2011 Oct:108(7):1132-8. doi: 10.1111/j.1464-410X.2010.09993.x.
52. Khandelwal C, Kistler C. Diagnosis of urinary incontinence. American family physician. 2013 Apr 15:87(8):543-50
53. Thomas-White KJ, Hilt EE, Fok C, Pearce MM, Mueller ER, Kliethermes S, Jacobs K, Zilliox MJ, Brincat C, Price TK, Kuffel G, Schreckenberger P, Gai X, Brubaker L, Wolfe AJ. Incontinence medication response relates to the female urinary microbiota. International urogynecology journal. 2016 May:27(5):723-33. doi: 10.1007/s00192-015-2847-x.
54. Pearce MM, Hilt EE, Rosenfeld AB, Zilliox MJ, Thomas-White K, Fok C, Kliethermes S, Schreckenberger PC, Brubaker L, Gai X, Wolfe AJ. The female urinary microbiome: a comparison of women with and without urgency urinary incontinence. mBio. 2014 Jul 8:5(4):e01283-14. doi: 10.1128/mBio.01283-14.
55. Taweel WA, Seyam R. Neurogenic bladder in spinal cord injury patients. Research and reports in urology. 2015:7():85-99. doi: 10.2147/RRU.S29644.
56. Nygaard I. Clinical practice. Idiopathic urgency urinary incontinence. The New England journal of medicine. 2010 Sep 16:363(12):1156-62. doi: 10.1056/NEJMcp1003849.
57. Aoki Y, Brown HW, Brubaker L, Cornu JN, Daly JO, Cartwright R. Urinary incontinence in women. Nature reviews. Disease primers. 2017 Jul 6:3():17042. doi: 10.1038/nrdp.2017.42.
58. Stewart F, Gameiro LF, El Dib R, Gameiro MO, Kapoor A, Amaro JL. Electrical stimulation with non-implanted electrodes for overactive bladder in adults. The Cochrane database of systematic reviews. 2016 Dec 9:12(12):CD010098. doi: 10.1002/14651858.CD010098.pub4.
59. . Committee Opinion No. 603: Evaluation of uncomplicated stress urinary incontinence in women before surgical treatment. Obstetrics and gynecology. 2014 Jun:123(6):1403-1407. doi: 10.1097/01.AOG.0000450759.34453.31.
60. Holroyd-Leduc JM, Tannenbaum C, Thorpe KE, Straus SE. What type of urinary incontinence does this woman have? JAMA. 2008 Mar 26:299(12):1446-56. doi: 10.1001/jama.299.12.1446.
61. Harvey MA, Versi E. Predictive value of clinical evaluation of stress urinary incontinence: a summary of the published literature. International urogynecology journal and pelvic floor dysfunction. 2001:12(1):31-7
62. Winters JC, Dmochowski RR, Goldman HB, Herndon CD, Kobashi KC, Kraus SR, Lemack GE, Nitti VW, Rovner ES, Wein AJ, American Urological Association, Society of Urodynamics, Female Pelvic Medicine & Urogenital Reconstruction. Urodynamic studies in adults:

AUA/SUFU guideline. The Journal of urology. 2012 Dec:188(6 Suppl):2464-72. doi: 10.1016/j.juro.2012.09.081.
63. Milleman M, Langenstroer P, Guralnick ML. Post-void residual urine volume in women with overactive bladder symptoms. The Journal of urology. 2004 Nov:172(5 Pt 1):1911
64. Wyman JF, Choi SC, Harkins SW, Wilson MS, Fantl JA. The urinary diary in evaluation of incontinent women: a test-retest analysis. Obstetrics and gynecology. 1988 Jun:71(6 Pt 1):812-7
65. Homma Y, Ando T, Yoshida M, Kageyama S, Takei M, Kimoto K, Ishizuka O, Gotoh M, Hashimoto T. Voiding and incontinence frequencies: variability of diary data and required diary length. Neurourology and urodynamics. 2002:21(3):204-9
66. Mehta S, Geng B, Xu X, Harmanli O. Current state of bladder diary: a survey and review of the literature. International urogynecology journal. 2023 Apr:34(4):809-823. doi: 10.1007/s00192-022-05398-w.
67. Nambiar AK, Arlandis S, Bø K, Cobussen-Boekhorst H, Costantini E, de Heide M, Farag F, Groen J, Karavitakis M, Lapitan MC, Manso M, Arteaga SM, Riogh ANA, O'Connor E, Omar MI, Peyronnet B, Phé V, Sakalis VI, Sihra N, Tzelves L, van Poelgeest-Pomfret ML, van den Bos TWL, van der Vaart H, Harding CK. European Association of Urology Guidelines on the Diagnosis and Management of Female Non-neurogenic Lower Urinary Tract Symptoms. Part 1: Diagnostics, Overactive Bladder, Stress Urinary Incontinence, and Mixed Urinary Incontinence. European urology. 2022 Jul:82(1):49-59. doi: 10.1016/j.eururo.2022.01.045.
68. Espuña-Pons M, Diez-Itza I, Anglès-Acedo S, Covernton PJO, GISPEM group. Cough stress tests to diagnose stress urinary incontinence in women with pelvic organ prolapse with indication for surgical treatment. Neurourology and urodynamics. 2020 Feb:39(2):819-825. doi: 10.1002/nau.24288.
69. Long CY, Loo ZX, Wu CH, Lin KL, Yeh CL, Feng CW, Wu PC. Relationship between Q-Tip Test and Urethral Hypermobility on Perineal Ultrasound. Journal of clinical medicine. 2023 Jul 24:12(14):. doi: 10.3390/jcm12144863.
70. Wu CJ, Ting WH, Lin HH, Hsiao SM. Clinical and Urodynamic Predictors of the Q-Tip Test in Women With Lower Urinary Tract Symptoms. International neurourology journal. 2020 Mar:24(1):52-58. doi: 10.5213/inj.1938156.078.
71. Jha S, Jeppson PC, Dokmeci F, Marquini GV, Sartori MGF, Moalli P, Malik SA. Management of mixed urinary incontinence: IUGA committee opinion. International urogynecology journal. 2024 Feb:35(2):291-301. doi: 10.1007/s00192-023-05694-z.
72. Hu Y, Lou Y, Liao L, Xu M, Zhang H, Yang Q, Wu H. Comparison of Urodynamics and Perineal Ultrasonography for the Diagnosis of Mixed Urinary Incontinence in Women. Journal of ultrasound in medicine : official journal of the American Institute of Ultrasound in Medicine. 2018 Nov:37(11):2647-2656. doi: 10.1002/jum.14626.
73. Collins CW,Winters JC, AUA/SUFU adult urodynamics guideline: a clinical review. The Urologic clinics of North America. 2014 Aug
74. Sinha S, Lakhani D, Singh VP. Cough associated detrusor overactivity in women with urinary incontinence. Neurourology and urodynamics. 2019 Mar:38(3):920-926. doi: 10.1002/nau.23928.
75. Rosier PF, Gajewski JB, Sand PK, Szabó L, Capewell A, Hosker GL, International Consultation on Incontinence 2008 Committee on Dynamic Testing. Executive summary: The International Consultation on Incontinence 2008--Committee on: "Dynamic Testing"; for urinary incontinence and for fecal incontinence. Part 1: Innovations in urodynamic techniques and urodynamic testing for signs and symptoms of urinary incontinence in female patients. Neurourology and urodynamics. 2010:29(1):140-5. doi: 10.1002/nau.20764.
76. Yao M, Simoes A. Urodynamic Testing and Interpretation. StatPearls. 2024 Jan
77. Tabei SS, Baas W, Mahdy A. Pharmacotherapy in Stress Urinary Incontinence; A Literature Review. Current urology reports. 2024 May 10:():. doi: 10.1007/s11934-024-01205-9.
78. Strojek K, Strączyńska A, Radzimińska A, Weber-Rajek M. The Effects of Extracorporeal Magnetic Innervation in the Treatment of Women with Urinary Incontinence: A Systematic Review. Journal of clinical medicine. 2023 Aug 22:12(17):. doi: 10.3390/jcm12175455.
79. Bai J, Tian Y, Wang Y, Zhang X, Wang P. Physical and Rehabilitation Therapy for Overactive Bladder in Women: A Systematic Review and Meta-Analysis. International journal of clinical practice. 2023:2023():6758454. doi: 10.1155/2023/6758454.
80. Yin Y, Zhao C, Liu M, Chen J. Effect of Electroacupuncture Combined with Pelvic Floor Muscle Exercise on Urinary Symptoms, Sexual Dysfunction and Pelvic Floor Muscle Strength in Female Patients with Overactive Bladder: A Retrospective Study. Archivos espanoles de urologia. 2024 Apr:77(3):256-262. doi: 10.56434/j.arch.esp.urol.20247703.34.
81. Wenming C, Xiaoman D, Ling G, Yun L, Xiyan G. Acupuncture combined with pelvic floor rehabilitation training for postpartum stress urinary incontinence: protocol for a systematic

review and meta-analysis. Frontiers in medicine. 2023:10():1296751. doi: 10.3389/fmed.2023.1296751.
82. Long Z, Chen H, Yu S, Wang X, Liu Z. Effect of Acupuncture for Mixed Urinary Incontinence in Women: A Systematic Review. Frontiers in public health. 2022:10():827853. doi: 10.3389/fpubh.2022.827853.
83. Hargreaves E, Baker K, Barry G, Harding C, Zhang Y, Kandala NB, Zhang X, Kernohan A, Clarkson CE. Acupuncture for treating overactive bladder in adults. The Cochrane database of systematic reviews. 2022 Sep 23:9(9):CD013519. doi: 10.1002/14651858.CD013519.pub2.
84. . Urinary incontinence and pelvic organ prolapse in women: management. 2019 Jun
85. Funada S, Yoshioka T, Luo Y, Sato A, Akamatsu S, Watanabe N. Bladder training for treating overactive bladder in adults. The Cochrane database of systematic reviews. 2023 Oct 9:10(10):CD013571. doi: 10.1002/14651858.CD013571.pub2.
86. Gordon B. Nutritional Considerations for Bladder Storage Conditions in Adult Females. International journal of environmental research and public health. 2023 Oct 3:20(19):. doi: 10.3390/ijerph20196879.
87. Balk EM, Rofeberg VN, Adam GP, Kimmel HJ, Trikalinos TA, Jeppson PC. Pharmacologic and Nonpharmacologic Treatments for Urinary Incontinence in Women: A Systematic Review and Network Meta-analysis of Clinical Outcomes. Annals of internal medicine. 2019 Apr 2:170(7):465-479. doi: 10.7326/M18-3227.
88. Nambiar AK, Bosch R, Cruz F, Lemack GE, Thiruchelvam N, Tubaro A, Bedretdinova DA, Ambühl D, Farag F, Lombardo R, Schneider MP, Burkhard FC. EAU Guidelines on Assessment and Nonsurgical Management of Urinary Incontinence. European urology. 2018 Apr:73(4):596-609. doi: 10.1016/j.eururo.2017.12.031.
89. Dufour S, Wu M. No. 397 - Conservative Care of Urinary Incontinence in Women. Journal of obstetrics and gynaecology Canada : JOGC = Journal d'obstetrique et gynecologie du Canada : JOGC. 2020 Apr:42(4):510-522. doi: 10.1016/j.jogc.2019.04.009.
90. Miller JM, Hawthorne KM, Park L, Tolbert M, Bies K, Garcia C, Misiunas R, Newhouse W, Smith AR. Self-Perceived Improvement in Bladder Health After Viewing a Novel Tutorial on Knack Use: A Randomized Controlled Trial Pilot Study. Journal of women's health (2002). 2020 Oct:29(10):1319-1327. doi: 10.1089/jwh.2018.7606.
91. Miller JM, Ashton-Miller JA, Delancey JO. Quantification of cough-related urine loss using the paper towel test. Obstetrics and gynecology. 1998 May:91(5 Pt 1):705-9
92. Miller JM, Umek WH, Delancey JO, Ashton-Miller JA. Can women without visible pubococcygeal muscle in MR images still increase urethral closure pressures? American journal of obstetrics and gynecology. 2004 Jul:191(1):171-5
93. Mayer R, Wells TJ, Brink CA, Clark P. Correlations between dynamic urethral profilometry and perivaginal pelvic muscle activity. Neurourology and urodynamics. 1994:13(3):227-35
94. Miller JM, Perucchini D, Carchidi LT, DeLancey JO, Ashton-Miller J. Pelvic floor muscle contraction during a cough and decreased vesical neck mobility. Obstetrics and gynecology. 2001 Feb:97(2):255-60
95. Burgio KL, Goode PS, Locher JL, Umlauf MG, Roth DL, Richter HE, Varner RE, Lloyd LK. Behavioral training with and without biofeedback in the treatment of urge incontinence in older women: a randomized controlled trial. JAMA. 2002 Nov 13:288(18):2293-9
96. Lúcio A, Lourenço CB, Damasceno BP, de Moraes Lopes MHB, D'ancona CAL. The Effect of Pelvic Floor Muscle Contraction on Detrusor Overactivity Pressure in Neurogenic and Nonneurogenic Women During Urodynamic Study: A Cross-Sectional Study. American journal of physical medicine & rehabilitation. 2019 Apr:98(4):275-279. doi: 10.1097/PHM.0000000000001065.
97. Zubieta M, Carr RL, Drake MJ, Bø K. Influence of voluntary pelvic floor muscle contraction and pelvic floor muscle training on urethral closure pressures: a systematic literature review. International urogynecology journal. 2016 May:27(5):687-96. doi: 10.1007/s00192-015-2856-9.
98. Brækken IH, Villumstad TKLS, Evensen NM. Randomised controlled pilot trial to assess effect of electrical stimulation of weak pelvic floor muscles. Archives of gynecology and obstetrics. 2024 Mar 29:():. doi: 10.1007/s00404-024-07389-2.
99. Liao L, Li X, Chong T, Chen Q, Xu Z, Huang B, Chen M, Li H, Wei Z, Shao Y, Lu J, Pang R, Li X, Wang Y. Efficacy and safety of tibial nerve stimulation using a wearable device for overactive bladder. BJU international. 2024 Jun:133(6):760-769. doi: 10.1111/bju.16330.
100. Barba M, Cola A, Rezzan G, Costa C, Re I, Volontè S, Terzoni S, Frigerio M, Maruccia S. Flat Magnetic Stimulation for Urge Urinary Incontinence. Medicina (Kaunas, Lithuania). 2023 Nov 14:59(11):. doi: 10.3390/medicina59111999.

101. Ghaderi F, Kharaji G, Hajebrahimi S, Pashazadeh F, Berghmans B, Pourmehr HS. Physiotherapy in Patients with Stress Urinary Incontinence: A Systematic Review and Meta-analysis. Urology research & practice. 2023 Sep:49(5):293-306. doi: 10.5152/tud.2023.23018.
102. Gumussoy S, Kavlak O, Yeniel AO. Effects of Biofeedback-Guided Pelvic Floor Muscle Training With and Without Extracorporeal Magnetic Innervation Therapy on Stress Incontinence: A Randomized Controlled Trial. Journal of wound, ostomy, and continence nursing : official publication of The Wound, Ostomy and Continence Nurses Society. 2021 Mar-Apr 01:48(2):153-161. doi: 10.1097/WON.0000000000000740.
103. Weber-Rajek M, Strączyńska A, Strojek K, Piekorz Z, Pilarska B, Podhorecka M, Sobieralska-Michalak K, Goch A, Radzimińska A. Assessment of the Effectiveness of Pelvic Floor Muscle Training (PFMT) and Extracorporeal Magnetic Innervation (ExMI) in Treatment of Stress Urinary Incontinence in Women: A Randomized Controlled Trial. BioMed research international. 2020:2020():1019872. doi: 10.1155/2020/1019872.
104. Hoşcan MB, Dilmen C, Perk H, Soyupek S, Armağan A, Tükel O, Ekinci M. Extracorporeal magnetic innervation for the treatment of stress urinary incontinence: results of two-year follow-up. Urologia internationalis. 2008:81(2):167-72. doi: 10.1159/000144055.
105. Huang J, Fan Y, Wang D, Deng Q, Zou X, Yu J. Efficacy and safety of vaginal electrical stimulation as an alternative or adjunct treatment for overactive bladder syndrome in women: a meta-analysis of randomized controlled trials. International urogynecology journal. 2023 Oct:34(10):2345-2357. doi: 10.1007/s00192-023-05546-w.
106. Burton CS, Korsandi S, Enemchukwu E. Current State of Non-surgical Devices for Female Stress Urinary Incontinence. Current urology reports. 2022 Sep:23(9):185-194. doi: 10.1007/s11934-022-01104-x.
107. Funada S, Luo Y, Uozumi R, Watanabe N, Goto T, Negoro H, Ueno K, Ichioka K, Segawa T, Akechi T, Ogawa O, Akamatsu S, Kobayashi T, Furukawa TA. Multicomponent Intervention for Overactive Bladder in Women: A Randomized Clinical Trial. JAMA network open. 2024 Mar 4:7(3):e241784. doi: 10.1001/jamanetworkopen.2024.1784.
108. Scaldazza CV, Morosetti C, Giampieretti R, Lorenzetti R, Baroni M. Percutaneous tibial nerve stimulation versus electrical stimulation with pelvic floor muscle training for overactive bladder syndrome in women: results of a randomized controlled study. International braz j urol : official journal of the Brazilian Society of Urology. 2017 Jan-Feb:43(1):121-126. doi: 10.1590/S1677-5538.IBJU.2015.0719.
109. Wang AC, Wang YY, Chen MC. Single-blind, randomized trial of pelvic floor muscle training, biofeedback-assisted pelvic floor muscle training, and electrical stimulation in the management of overactive bladder. Urology. 2004 Jan:63(1):61-6
110. Ghossein N, Kang M, Lakhkar AD. Anticholinergic Medications. StatPearls. 2024 Jan
111. Dawood O, El-Zawahry A. Mirabegron. StatPearls. 2024 Jan
112. Dwyer J, Tafuri SM, LaGrange CA. Oxybutynin. StatPearls. 2024 Jan
113. Narain S, Parmar M. Tolterodine. StatPearls. 2024 Jan
114. Uhr A, Glick L, Barron S, Zavodnick J, Mark JR, Shenot P, Murphy A. How I Do It: PureWick female external catheter: a non-invasive urine management system for incontinent women. The Canadian journal of urology. 2021 Jun:28(3):10669-10672
115. Cilluffo S, Terzoni S, Destrebecq A, Lusignani M. Efficacy, effectiveness, usability and acceptability of devices for female urinary incontinence: A scoping review. Journal of clinical nursing. 2023 Jul:32(13-14):3361-3377. doi: 10.1111/jocn.16457.
116. Beeson T, Pittman J, Davis CR. Effectiveness of an External Urinary Device for Female Anatomy and Trends in Catheter-Associated Urinary Tract Infections. Journal of wound, ostomy, and continence nursing : official publication of The Wound, Ostomy and Continence Nurses Society. 2023 Mar-Apr 01:50(2):137-141. doi: 10.1097/WON.0000000000000951.
117. Jasperse N, Hernandez-Dominguez O, Deyell JS, Prasad JP, Yuan C, Tomy M, Kuza CM, Grigorian A, Nahmias J. A single institution pre-/post-comparison after introduction of an external urinary collection device for female medical patients. Journal of infection prevention. 2022 Jul:23(4):149-154. doi: 10.1177/17571774211060423.
118. Khosla L, Sani JM, Chughtai B. Patient and caretaker satisfaction with the PureWick system. The Canadian journal of urology. 2022 Aug:29(4):11216-11223
119. Bagley K, Severud L Preventing Catheter-Associated Urinary Tract Infections with Incontinence Management Alternatives: PureWick and Condom Catheter. The Nursing clinics of North America. 2021 Sep
120. Al-Shaikh G, Syed S, Osman S, Bogis A, Al-Badr A. Pessary use in stress urinary incontinence: a review of advantages, complications, patient satisfaction, and quality of

life. International journal of women's health. 2018:10():195-201. doi: 10.2147/IJWH.S152616.
121. Nygaard I. Prevention of exercise incontinence with mechanical devices. The Journal of reproductive medicine. 1995 Feb:40(2):89-94
122. Wood LN, Anger JT. Urinary incontinence in women. BMJ (Clinical research ed.). 2014 Sep 15:349():g4531. doi: 10.1136/bmj.g4531.
123. Roehl B, Buchanan EM. Urinary incontinence evaluation and the utility of pessaries in older women. Care management journals : Journal of case management ; The journal of long term home health care. 2006 Winter:7(4):213-7
124. Komesu YM, Ketai LH, Rogers RG, Eberhardt SC, Pohl J. Restoration of continence by pessaries: magnetic resonance imaging assessment of mechanism of action. American journal of obstetrics and gynecology. 2008 May:198(5):563.e1-6. doi: 10.1016/j.ajog.2008.01.047.
125. Trowbridge ER, Fenner DE. Practicalities and pitfalls of pessaries in older women. Clinical obstetrics and gynecology. 2007 Sep:50(3):709-19
126. Donnelly MJ, Powell-Morgan S, Olsen AL, Nygaard IE. Vaginal pessaries for the management of stress and mixed urinary incontinence. International urogynecology journal and pelvic floor dysfunction. 2004 Sep-Oct:15(5):302-7
127. Subak LL, Quesenberry CP, Posner SF, Cattolica E, Soghikian K. The effect of behavioral therapy on urinary incontinence: a randomized controlled trial. Obstetrics and gynecology. 2002 Jul:100(1):72-8
128. Lorzadeh N, Jahanshahi M. The effect of duloxetine on stress urinary incontinence. Health science reports. 2024 May:7(5):e2091. doi: 10.1002/hsr2.2091.
129. Shamliyan T, Wyman JF, Ramakrishnan R, Sainfort F, Kane RL. Benefits and harms of pharmacologic treatment for urinary incontinence in women: a systematic review. Annals of internal medicine. 2012 Jun 19:156(12):861-74, W301-10. doi: 10.7326/0003-4819-156-12-201206190-00436.
130. Kreydin EI, Gomes CM, Cruz F. Current pharmacotherapy of overactive bladder. International braz j urol : official journal of the Brazilian Society of Urology. 2021 Nov-Dec:47(6):1091-1107. doi: 10.1590/S1677-5538.IBJU.2021.99.12.
131. Kornholt J, Sonne DP, Riis T, Sonne J, Klarskov N. Effect of imipramine on urethral opening pressure: A randomized, double-blind, placebo-controlled crossover study in healthy women. Neurourology and urodynamics. 2019 Apr:38(4):1076-1080. doi: 10.1002/nau.23955.
132. Tsakiris P, de la Rosette JJ, Michel MC, Oelke M. Pharmacologic treatment of male stress urinary incontinence: systematic review of the literature and levels of evidence. European urology. 2008 Jan:53(1):53-9
133. Dhaliwal JS, Spurling BC, Molla M. Duloxetine. StatPearls. 2025 Jan
134. Kotecha P, Sahai A, Malde S. Use of Duloxetine for Postprostatectomy Stress Urinary Incontinence: A Systematic Review. European urology focus. 2021 May:7(3):618-628. doi: 10.1016/j.euf.2020.06.007.
135. Hagovska M, Svihra J. Evaluation of duloxetine and innovative pelvic floor muscle training in women with stress urinary incontinence (DULOXING): Study protocol clinical trial (SPIRIT Compliant). Medicine. 2020 Feb:99(6):e18834. doi: 10.1097/MD.0000000000018834.
136. Yono M, Otani M, Ito K, Inoue Y, Furukawa K, Hori M, Tsuji S, Tanaka T, Sakata Y, Irie S. Effect of Duloxetine on Urethral Resting Pressure and on Sphincter Contractility in Response to Coughing and Magnetic Stimulation in Healthy Women. Lower urinary tract symptoms. 2015 May:7(2):93-8. doi: 10.1111/luts.12057.
137. Maund E, Tendal B, Hróbjartsson A, Jørgensen KJ, Lundh A, Schroll J, Gøtzsche PC. Benefits and harms in clinical trials of duloxetine for treatment of major depressive disorder: comparison of clinical study reports, trial registries, and publications. BMJ (Clinical research ed.). 2014 Jun 4:348():g3510. doi: 10.1136/bmj.g3510.
138. Maund E, Guski LS, Gøtzsche PC. Considering benefits and harms of duloxetine for treatment of stress urinary incontinence: a meta-analysis of clinical study reports. CMAJ : Canadian Medical Association journal = journal de l'Association medicale canadienne. 2017 Feb 6:189(5):E194-E203. doi: 10.1503/cmaj.151104.
139. Martins DO, Pinho M, Caldas F, Pereira EG. Visual Hallucinations After Duloxetine Use. The primary care companion for CNS disorders. 2024 Jan 25:26(1):. pii: 23cr03595. doi: 10.4088/PCC.23cr03595.
140. Leslie SW, Sajjad H, Singh S. Nocturia. StatPearls. 2024 Jan
141. Feloney MP, Stauss K, Leslie SW. Sacral Neuromodulation. StatPearls. 2024 Jan
142. Lovatsis D, Easton W, Wilkie D. No. 248-Guidelines for the Evaluation and Treatment of Recurrent Urinary Incontinence Following Pelvic Floor Surgery. Journal of obstetrics and gynaecology Canada : JOGC = Journal d'obstetrique et gynecologie du Canada : JOGC. 2017 Sep:39(9):e309-e314. doi: 10.1016/j.jogc.2017.06.009.

143. Makajeva J, Watters C, Safioleas P. Cystocele. StatPearls. 2024 Jan
144. Ladd M, Tuma F. Rectocele. StatPearls. 2024 Jan
145. Aboseif C, Liu P. Pelvic Organ Prolapse. StatPearls. 2024 Jan
146. Eisner H, McIntosh GV. Pubovaginal Sling. StatPearls. 2024 Jan
147. Riggs JA. Retropubic cystourethropexy: a review of two operative procedures with long-term follow-up. Obstetrics and gynecology. 1986 Jul:68(1):98-105
148. Chen CJ, Thompson H. Uterine Prolapse. StatPearls. 2024 Jan
149. Kim MS, Lee GH, Na ED, Jang JH, Kim HC. The association of pelvic organ prolapse severity and improvement in overactive bladder symptoms after surgery for pelvic organ prolapse. Obstetrics & gynecology science. 2016 May:59(3):214-9. doi: 10.5468/ogs.2016.59.3.214
150. Haylen BT, de Ridder D, Freeman RM, Swift SE, Berghmans B, Lee J, Monga A, Petri E, Rizk DE, Sand PK, Schaer GN. An International Urogynecological Association (IUGA)/International Continence Society (ICS) joint report on the terminology for female pelvic floor dysfunction. International urogynecology journal. 2010 Jan:21(1):5-26. doi: 10.1007/s00192-009-0976-9.
151. Basu M, Duckett J. Effect of prolapse repair on voiding and the relationship to overactive bladder and detrusor overactivity. International urogynecology journal and pelvic floor dysfunction. 2009 May:20(5):499-504. doi: 10.1007/s00192-009-0807-z.
152. Ozkurkcugil C, Avci IE. Factors predicting treatment success in mixed urinary incontinence treated with midurethral sling. Lower urinary tract symptoms. 2023 Mar:15(2):50-56. doi: 10.1111/luts.12471.
153. Nash S, Aboseif S, Gilling P, Gretzer M, Samowitz H, Rose M, Slutsky J, Siegel S, Tu LM. Treatment with an adjustable long-term implant for post-prostatectomy stress incontinence: The ProACT™ pivotal trial. Neurourology and urodynamics. 2018 Nov:37(8):2854-2859. doi: 10.1002/nau.23802.
154. Klock JA, Palacios AR, Leslie SW, Feloney MP. Artificial Urinary Sphincters and Adjustable Dual-Balloon Continence Therapy in Men. StatPearls. 2024
155. Kong L, Coddington ND, Flynn BJ. Secondary placement of adjustable continence therapy (ProACT™) using open perineal technique: Case report of ProACT placement in a man with a devastated urethra following pelvic trauma and multiple AUS erosions. Urology case reports. 2023 Jul:49():102424. doi: 10.1016/j.eucr.2023.102424.
156. Ruggiero M, Pinar U, Popelin MB, Rod X, Denys P, Bazinet A, Chartier-Kastler E. Single center experience and long-term outcomes of implantable devices ACT and Pro-ACT (Uromedica, Irvin, CA, USA) - Adjustable continence Therapy for treatment of stress urinary incontinence. Progres en urologie : journal de l'Association francaise d'urologie et de la Societe francaise d'urologie. 2023 Feb:33(2):96-102. doi: 10.1016/j.purol.2022.12.004.
157. Munier P, Nicolas M, Tricard T, Droupy S, Costa P, Saussine C. What if artificial urinary sphincter is not possible? Feasibility and effectiveness of ProACT for patients with persistent stress urinary incontinence after radical prostatectomy treated by sling. Neurourology and urodynamics. 2020 Jun:39(5):1417-1422. doi: 10.1002/nau.24355.
158. Téllez C, Szczesniewski J, Virseda-Chamorro M, Arance I, Angulo JC. Update on Adjustable Trans-Obturator Male System (ATOMS) for Male Incontinence after Prostate Cancer Surgery. Current oncology (Toronto, Ont.). 2023 Apr 12:30(4):4153-4165. doi: 10.3390/curroncol30040316.
159. de Guerry ML, Demeestere A, Bergot C, de Hauteclocque A, Hascoet J, Bajeot AS, Ternynck C, Gamé X, Peyronnet B, Capon G, Perrouin-Verbe MA, Biardeau X. Adjustable Continence Therapy (ACT®) balloons to treat female stress urinary incontinence: effectiveness, safety and risk factors of failure and complication. International urogynecology journal. 2023 Apr:34(4):877-883. doi: 10.1007/s00192-022-05275-6.
160. Smith WJ, VanDyke ME, Venishetty N, Langford BT, Franzen BP, Morey AF. Surgical Management of Male Stress Incontinence: Techniques, Indications, and Pearls for Success. Research and reports in urology. 2023:15():217-232. doi: 10.2147/RRU.S395359.
161. Salciccia S, Viscuso P, Bevilacqua G, Tufano A, Casale P, De Berardinis E, Di Pierro GB, Cattarino S, Gentilucci A, Lourdes Lia F, Ivan DG, Rosati D, Del Giudice F, Sciarra A, Mariotti G. Comparison of Different Invasive Devices for the Treatment of Urinary Incontinence after Radical Prostatectomy. Advances in urology. 2022:2022():8736249. doi: 10.1155/2022/8736249.
162. Ricard H, Léon G, Branchereau J, Bouchot O, Karam G, Le Normand L, Rigaud J, Perrouin-Verbe MA. Adjustable continence balloons in postprostatectomy incontinence: Outcomes and complications. Neurourology and urodynamics. 2022 Aug:41(6):1414-1422. doi: 10.1002/nau.24967.
163. Demeestere A, de Guerry ML, Bergot C, de Hauteclocque A, Hascoet J, Gamé X, Bajeot AS,

Peyronnet B, Capon G, Perrouin-Verbe MA, Biardeau X. Adjustable continence therapy (ACT®) balloons to treat neurogenic and non-neurogenic female urinary incontinence. Neurourology and urodynamics. 2022 Jan:41(1):313-322. doi: 10.1002/nau.24822.

164. Kaboré FA, Gaillet S, Blanc J, Boissier R, Aurier KL, Delaporte V, Coulange C, Lechevallier E, Karsenty G. [Initial results of adjustable periurethral balloons (ACT™ and pro ACT™) in the treatment of adult stress urinary incontinence with intrinsic sphincter deficiency]. Progres en urologie : journal de l'Association francaise d'urologie et de la Societe francaise d'urologie. 2014 Dec:24(17):1132-8. doi: 10.1016/j.purol.2014.08.004.
165. Billault C, Chartier-Kastler E, Rouprêt M, Robain G, Phé V. Functional outcomes of adjustable continence therapy (ACT™) balloons in women aged }80 years and suffering from stress urinary incontinence caused by intrinsic sphincter deficiency. World journal of urology. 2015 Nov:33(11):1897-903. doi: 10.1007/s00345-015-1520-9.
166. Peyronnet B, Greenwell T, Gray G, Khavari R, Thiruchelvam N, Capon G, Ockrim J, Lopez-Fando L, Gilleran J, Fournier G, Van Koeveringe GA, Van Der Aa F. Current Use of the Artificial Urinary Sphincter in Adult Females. Current urology reports. 2020 Oct 24:21(12):53. doi: 10.1007/s11934-020-01001-1.
167. Denormandie A, Chartier-Kastler E, Haddad R, Robain G, Guillot-Tantay C, Phé V. Long-term functional outcomes of artificial urinary sphincter (AMS 800™) implantation in women aged over 75 years and suffering from stress urinary incontinence caused by intrinsic sphincter deficiency. World journal of urology. 2021 Oct:39(10):3897-3902. doi: 10.1007/s00345-021-03702-9.
168. Schroeder A, Munier P, Saussine C, Tricard T. Outcomes of laparoscopic artificial urinary sphincter in women with stress urinary incontinence: mid-term evaluation. World journal of urology. 2021 Aug:39(8):3057-3062. doi: 10.1007/s00345-020-03527-y.
169. Tricard T, Al Hashimi I, Schroeder A, Munier P, Saussine C. Real-life outcomes after artificial urinary sphincter explantation in women suffering from severe stress incontinence. World journal of urology. 2021 Oct:39(10):3891-3896. doi: 10.1007/s00345-021-03672-y.
170. Barakat B, Franke K, Hijazi S, Schakaki S, Gauger U, Hasselhof V, Vögeli TA. A systematic review and meta-analysis of clinical and functional outcomes of artificial urinary sphincter implantation in women with stress urinary incontinence. Arab journal of urology. 2020 Feb 4:18(2):78-87. doi: 10.1080/2090598X.2020.1716293.
171. Peyronnet B, O'Connor E, Khavari R, Capon G, Manunta A, Allue M, Hascoet J, Nitti VW, Gamé X, Gilleran J, Castro-Sader L, Cornu JN, Waltregny D, Ahyai S, Chung E, Elliott DS, Fournier G, Brucker BM. AMS-800 Artificial urinary sphincter in female patients with stress urinary incontinence: A systematic review. Neurourology and urodynamics. 2019 Aug:38 Suppl 4():S28-S41. doi: 10.1002/nau.23833.
172. Chung E, Liao L, Kim JH, Wang Z, Kitta T, Lin AT, Lee KS, Ye L, Chu P, Kaiho Y, Takei M, Jiang H, Lee J, Masuda H, Tse V. The Asia-Pacific AMS800 artificial urinary sphincter consensus statement. International journal of urology : official journal of the Japanese Urological Association. 2023 Feb:30(2):128-138. doi: 10.1111/iju.15083.
173. Shokri P, Kharaz L, Talebian N, Borumandnia N, Ziaee SAM, Shakhssalim N. A systematic review and meta-analysis of complications of artificial urinary sphincters in female patients with urinary incontinence due to internal sphincter insufficiency. BMC urology. 2023 May 20:23(1):97. doi: 10.1186/s12894-023-01274-x.
174. Ferreira C, Brychaert PE, Menard J, Mandron E. Laparoscopic implantation of artificial urinary sphincter in women with intrinsic sphincter deficiency: Mid-term outcomes. International journal of urology : official journal of the Japanese Urological Association. 2017 Apr:24(4):308-313. doi: 10.1111/iju.13296.
175. Peyronnet B, Gray G, Capon G, Cornu JN, Van Der Aa F. Robot-assisted artificial urinary sphincter implantation. Current opinion in urology. 2021 Jan:31(1):2-10. doi: 10.1097/MOU.0000000000000837.
176. Carson CC. Artificial urinary sphincter: current status and future directions. Asian journal of andrology. 2020 Mar-Apr:22(2):154-157. doi: 10.4103/aja.aja_5_20.
177. Lim YN, Dwyer PL. Effectiveness of midurethral slings in intrinsic sphincteric-related stress urinary incontinence. Current opinion in obstetrics & gynecology. 2009 Oct:21(5):428-33. doi: 10.1097/GCO.0b013e32832fd268.
178. Schierlitz L, Dwyer PL, Rosamilia A, Murray C, Thomas E, De Souza A, Lim YN, Hiscock R. Effectiveness of tension-free vaginal tape compared with transobturator tape in women with stress urinary incontinence and intrinsic sphincter deficiency: a randomized controlled trial. Obstetrics and gynecology. 2008 Dec:112(6):1253-1261. doi: 10.1097/AOG.0b013e31818db391.
179. Shah SM, Gaunay GS. Treatment options for intrinsic sphincter deficiency. Nature reviews.

Urology. 2012 Nov:9(11):638-51. doi: 10.1038/nrurol.2012.177.
180. Guérin S, Khene ZE, Peyronnet B. Adjustable Continence Therapy Balloons in Female Patients with Stress Urinary Incontinence: A Systematic Review. Urologia internationalis. 2023:107(7):653-665. doi: 10.1159/000529712.
181. Freton L, Tondut L, Enderle I, Hascoet J, Manunta A, Peyronnet B. Comparison of adjustable continence therapy periurethral balloons and artificial urinary sphincter in female patients with stress urinary incontinence due to intrinsic sphincter deficiency. International urogynecology journal. 2018 Jul:29(7):949-957. doi: 10.1007/s00192-017-3544-8.
182. Lee CL, Park JM, Lee JY, Yang SW, Na HS, Lee J, Jung S, Shin JH. A Novel Incisionless Disposable Vaginal Device for Female Stress Urinary Incontinence: Efficacy and Quality of Life. International neurourology journal. 2023 May:27(Suppl 1):S40-48. doi: 10.5213/inj.2346092.046.
183. McConnell EA. Applying a condom catheter. Nursing. 2001 Jan:31(1):70.