

Pragmatic Approaches and Clinical Rationale in Addressing Postpartum Stress Urinary Incontinence (UI) in Women

Nicholas A Kerna^{1,2*}, John V Flores^{3,4}, Sudeep Chawla⁵, Stephen M Brown⁶, ND Victor Carsrud⁷, Hilary M Holets^{3,4}, Uzoamaka Nwokorie⁸, Rashad Roberson⁹, Joseph Anderson II¹⁰ and Kevin D Pruitt^{11,12}

¹SMC–Medical Research, Thailand

²First InterHealth Group, Thailand

³Beverly Hills Wellness Surgical Institute, USA

⁴Orange Partners Surgicenter, USA

⁵Chawla Health & Research, USA

⁶International University of Health Sciences, St. Kitts

⁷Lakeline Wellness Center, USA

⁸Department of Physician Assistant, Howard University, USA

⁹Georgetown American University, College of Medicine, Guyana

¹⁰International Institute of Original Medicine, USA

¹¹Kemet Medical Consultants, USA

¹²PBJ Medical Associates, LLC, USA

***Corresponding Author:** Nicholas A Kerna, (mailing address) POB47 Phatphong, Suriwongse Road, Bangkok, Thailand 10500.

Contact: medpublab+drkerna@gmail.com

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Abstract

Postpartum urinary incontinence (UI) is a common and significant concern, affecting approximately 30% of women within the first three months of delivery. Multiple variables, such as unique genitourinary structure, pregnancy, number and type of delivery, menopause, constipation, hypertension, diabetes, and body mass index (BMI), aggravate risk factors. Aging causes the pelvic floor muscles to weaken, reducing structural support to pelvic organs, leading to UI. Urinary tract infection, occupation, level of physical activity, and working status are contributing factors for postpartum stress UI in women. Stress UI is the most commonly reported form of UI, with a prevalence of 54%. The incidence rate (31%) is similar in primiparae and multiparae women. Currently, most women prefer to deliver through a Cesarean section (C-section). The likelihood of developing stress UI increases in women giving birth vaginally compared to those opting for a C-section. UI is undiagnosed and untreated in nearly 50% of the affected patients, leading to secondary complications and increased disease burden. Women's health care providers should offer pregnant women adequate information and necessary audio-visual materials regarding UI. Pregnant women in the last trimester and those at risk of developing postpartum stress UI within 6 months of delivery must be provided sources discussing the benefits of pelvic floor muscle training (PFMT). This review provides an overview of the current practices to manage stress UI and highlights practical approaches to treat and prevent postpartum stress UI with pharmacological and non-pharmacological interventions.

Keywords: C-Section; Childbirth; Complication; Genitourinary; Pelvic Floor Muscle Training; Pregnancy; Urethra

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Abbreviations

App: application program; EPINCONT: Epidemiology of Incontinence in the County of Nord-Trøndelag; CNGOF: French College of Gynecologists and Obstetricians; MUCP: Maximal Urethral Closure Pressure; MUI: Mixed UI; OR: Odds Ratio; PFMT: Pelvic Floor Muscle Training; PVR: Post-Void Residual; UI: Urinary Incontinence; UUI: Urgency UI; UVJ-M: Mobility of Ureterovesical Junction; QoL: Quality of Life

Introduction

In 1935, D. E. Derry was inspecting the mummy “Henhenit” at the Egyptian University, Cairo, to decipher the mummification method used during the eleventh dynasty (BCE 2050) [1]. The abdominal cavity examination showed a large vesicovaginal fistula, apparently from a birth trauma exacerbated by perineal laceration [2].

The first mention of postpartum urinary incontinence (UI) in the medical literature was recorded in the late nineteenth century, when urine retention was common and postpartum UI was considered rare and incurable.

In 1881, Milne Murray presented a case report of a multiparous woman, possibly with two previous childbirths, with complaints of the inability to retain urine [3]. Treatment with electrogalvanic stimulation to tone and grow the sphincter muscle tissue was successful; the patient showed signs of improvement during subsequent follow-ups [3]. Studies during the early twentieth century proposed various preventive, surgical, and pharmacological interventions for postpartum UI, but they did not have much of an impact on clinical practice [4-6].

Researchers van Geelen, *et al.* (1882) reported that nulliparous (i.e. women with no history of childbirth) women with considerably low urethral pressure values and inadequate pressure transmission experienced stress UI during or after pregnancy [7].

Mason, *et al.* (1999) discovered a significant correlation ($P = 0.001$) between parity and occurrence of postpartum stress UI in women visiting antenatal clinics in Liverpool, England [8]. Parity is typically defined as the number of deliveries of a fetus with a gestational age of ≥ 24 weeks [9]. As mentioned above, an all-inclusive, survey-based, prospective study involved two questionnaires: the first questionnaire to women at 34 weeks of gestation, followed by the second questionnaire at 8 weeks after delivery [8]. The study found that the prevalence of postpartum stress UI was lower in primiparae women (para 1; i.e., women with only one childbirth) than in multiparae women (para 2, 3, 4, and 5+) [8].

Although no significant difference in postpartum stress UI incidence was noted in both standard and instrumental delivery methods, C-section delivery was associated with a lower incidence than standard spontaneous vaginal delivery [8].

Rortveit, *et al.* (2003) conducted the “Epidemiology of Incontinence in the County of Nord-Trøndelag” (EPINCONT), a community-based cohort study comprising 15,307 women in Norway. The study concluded that C-section poses a higher risk of developing stress UI in nulliparous women [10]. Press, *et al.* (2007) wrote of a similar outcome in their systematic review of 12 cohorts and 6 cross-sectional studies. They found that C-section reduced the short-term risk of postpartum stress UI compared to vaginal delivery [11].

Despite several studies on postpartum stress UI, clinical guidelines on the prevention and management of postpartum stress UI are lacking. The high burden and interdependence of childbirth, pregnancy, and stress UI emphasize the need for health care professionals primarily involved in women’s health to be competent with strategies used to prevent, diagnose, treat, and cure the condition. As such, this review serves as a comprehensive primer, highlighting pragmatic approaches and providing the rationale for clinical decision-making.

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Discussion

Risk factors of postpartum stress UI

About 30% of women experience postpartum UI within the first 3 months after labor [12]. UI is a pathological state characterized by uncontrollable or involuntary leakage of any urine volume [13]. There are two types of incontinence: transient and chronic. Transient incontinence is an acute condition in which urinary leakage can be spontaneously reversed by treating the underlying illnesses or medical conditions [14]. On the contrary, chronic incontinence is irreversible and may persist for long durations. Based on pathophysiology and clinical presentation, UI is classified into six subtypes: stress incontinence, urge incontinence, mixed incontinence, overflow incontinence, functional incontinence, and reflex incontinence [15].

The most frequent UIs occurring after childbirth are stress UI, urgency UI (UUI), and mixed UI (MUI) [16]. UUI is the involuntary loss of urine due to urgency, whereas stress UI is due to effort or physical exertion, such as exercising, sneezing, coughing, and jumping [17]. MUI is the occurrence of involuntary micturition due to urgency and effort or physical exertion [17]. UUI primarily occurs from increased afferent nerve activity caused by overactive bladder and detrusor, whereas urethral hypermobility, a direct consequence of mechanical trauma during pregnancy or vaginal delivery, leads to stress UI [18].

The unique genitourinary structure, pregnancy, number of deliveries, type of delivery, menopause, constipation, hypertension, diabetes, and BMI are some of the aggravating risk factors [19]. Additionally, pelvic floor muscles may become weak due to aging, eventually reducing the structural support to pelvic organs, resulting in UI. Moreover, urinary tract infection, occupation, level of physical activity, and working status can contribute to UI [20].

Prevalence of postpartum stress UI

The higher prevalence of both stress UI and UUI during pregnancy and the high incidence of stress UI following vaginal delivery can be attributed to distinct biological mechanisms and etiology. A prospective study conducted at the Gynecological Department of the University of Insubria, Varese, Italy, by Serati, *et al.* (2016) determined the association between maternal position during the second stage of labor and the incidence rate of postpartum stress UI. The researchers found that the episiotomy rate was higher, and second-degree perineal tears were lower in the supine position than in the upright position. However, the incidence of postpartum stress UI was significantly lower in the upright position than in the supine position (20.6% vs. 28.3%; $P = 0.02$) [21].

Spontaneous vaginal delivery appeared to ameliorate the prevalence of stress UI after ten years of the first delivery [22,23]. Similarly, regarding long-term outcomes, the prevalence of moderate-to-severe stress UI was higher with vaginal delivery than with C-section twenty years after the first childbirth [24].

Tähtinen, *et al.* (2016) evaluated the long-term effects of the mode of delivery on stress UI. They found that the risk of developing long-term stress UI was twice as likely with vaginal delivery than with C-section [25]. Additionally, an absolute increase of about 8% was discovered, with younger women exhibiting a substantial effect from vaginal delivery [25].

In a multicenter randomized clinical trial, Hutton, *et al.* (2018) reported a lower UI incidence in the planned C-section group (8.11%) than in the planned vaginal birth group (12.25%) [odds ratio (OR): 0.63; 95% CI, 0.47 – 0.83; $P = 0.001$] [26].

Tayrac, *et al.* (2019) conducted a multicenter prospective cohort study involving 2812 primiparous women bearing twins and no history of UI. Both stress UI and MUI combined were significantly higher in the vaginal delivery group than in the C-section group at three months (35% vs. 17%; $P < 0.0001$) and twelve months (38% vs. 24%, $P < 0.0001$) after delivery. This study demonstrated the high risk of vaginal delivery and developing postpartum stress UI or MUI within three months after giving birth to twins [27].

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A meta-analysis by Moossdorff-Steinhauser, *et al.* (2021) scrutinized 24 studies from the past two decades, comprising a total of 35,064 Western women. The weighted arithmetic mean (\bar{x}) for UI prevalence was almost 31% (CI: 26.0 – 36.0%; percentage of variation (I^2) = 99.0%), which had an early dip (\bar{x} = 21.0%, 95% CI: 17.0 – 25.0%) at 3 months postpartum, gradually increasing to 32% by the 1-year mark [16]. The stratified analysis in 9 studies with respect to the UI type found the incidence rates as follows: stress UI: 54%; UUI: 26%; MUI: 16%; indistinguishable UI: 4%. Moreover, the prevalence by parity was similar (31%) in both primiparae and multiparae women [16].

Daly, *et al.* (2017) recruited 860 nulliparae women during pregnancy in a cohort study. Stress UI was reported by 22.6% of women before pregnancy and 37.2% during pregnancy. Of all new-onset UI during pregnancy, stress UI was noted in 50% of women. A key finding from this longitudinal study was the significant correlation between prepregnancy UI and a history of childhood enuresis or BMI \geq 30 kg/m² in nulliparous women. In addition, age \geq 35 years, obesity or excess body weight, or urinary leakage at least once a month appeared to predispose nulliparous women to the risk of developing UI [28].

In another study by Almousa S., *et al.* (2019), involving nulliparae female athletes, the prevalence of stress UI ranged from 10.3% to 61.1% (31.6% \pm 17.4; mean \pm SD) [29]. Additionally, a prospective longitudinal study by Chang, *et al.* (2021) found that women aged \geq 30 years who underwent high-vacuum extraction or forceps delivery were at a higher risk of developing stress UI in the first postpartum year ($P < 0.05$) [30].

Complications of postpartum stress UI

In an observational study by van de Vaart H., *et al.* (2010), the prevalence of at least some form of UI was found in one-third of middle-aged women involved in the Northern California integrated health care delivery system. However, the trend showed that only half of them sought professional help [31]. The significant consequences of untreated or undiagnosed incontinence are summarized in Table 1.

Complications of postpartum stress UI	Consequence if untreated
Infections	If not detected or treated appropriately, urinary tract infections may pass into the kidneys and bloodstream, causing infections elsewhere in the body. Chances of acquiring dermatitis, rashes, sores, and inflammatory diseases are increased.
Pelvic Floor Dysfunction	This dysfunction may signify gynecological or neurological cancers affecting the bladder’s nerves or neurodegenerative disorders, such as Alzheimer’s disease. They mostly lead to other urinary dysfunctions, such as nocturia or dysuria.
Anxiety/Depression	Mental health issues due to stress UI can lead to long-term debilitation, anger, and frustration, as well constant fear of having an accident in public and not making it to the bathroom.
The rapid decline in elderly individuals	Elderly individuals are more prone to fall and sustain severe injuries while hurrying to micturate; such mishaps can be avoided if timely treatment is offered.
Obesity/Weight gain	An additional load may exert pressure on the urethra and exacerbate the incontinence; thus, such patients may become inactive because of the fear of incontinence during exercising.
General Quality of Life	Incontinence at work may affect productivity and relationships. It can also lead to sexual dysfunctions. The condition may also limit day-to-day activities, reduce self-esteem, and cause a sense of helplessness.

Table 1: Significant complications of untreated stress urinary incontinence in women following childbirth.

Assessment of postpartum stress UI

The most important criteria for assessing postpartum stress UI in women is determining their medical history and the frequency and severity of leakage. Various tools and techniques—such as self-reporting QoL, symptoms-based questionnaires specific to UI, bladder diary (App-based and charts), and pad test—can be used to assess UI [31–33]. A 3-day bladder diary helps document the frequency of urination, urinary volume, and frequency of leakage [34]. Several methods—such as endoscopy, urethral pressure measurement, urine dynamics, and magnetic resonance imaging—are available to evaluate stress UI. Reproducible and straightforward cough stress tests aid in diagnosing stress UI.

A positive value indicates intrinsic urethral sphincter deficiency in the test, and a negative value suggests further inspection of the bladder volume followed by repetition with the patient standing upright [35]. The test performed in various positions in women with postpartum stress UI is recommended before surgery [36].

The urethral hypermobility evaluation is recommended before stress UI surgery, but currently available approaches lack reliability and precision. Urethral mobility is assessed by observation, POP-Q point Aa measurement, Q-tip test, and other supportive configurations [37,38].

Although urethral mobility determined by Q-tip does tally with ultrasonography or urethrocytography, these result in poor sub-urethral tape procedures [37,39]. Because the POP-Q system cannot rule out quantifying cervical-urethral hypermobility [39], it is not preferred for diagnosing stress UI.

A comprehensive clinical evaluation of stress UI is performed, comprising urine loss volume on exertion, coughing, or laughing; positive cough stress test; post-void residual (PVR) volume > 50 mL; and functional bladder capacity <400 mL (which demonstrates correlation with a urodynamic test) [40].

Especially for stress UI, urodynamic findings are not required before surgical interventions—if essential clinical evaluation (standardized questionnaires, cough stress test, bladder diary, PVR volume) show concordant data [41]. Nevertheless, if urodynamic assessments are performed in an adult female without neurological disease, free uroflowmetry, PVR volume, filling and voiding cystometry, urethral profile accompanied by maximal urethral closure pressure measurement (MUCP), and Valsalva leak point pressure are helpful [42].

Management of postpartum stress UI

Conservative or non-invasive treatment

Conservative treatment of postpartum stress UI involves using low-risk approaches that are reversible and individualized. These are the preferred first-line treatment options for women with stress UI. Pelvic floor physiotherapy, behavioral therapy, bladder retraining, pharmacological intervention, and the use of anti-incontinence devices are the standard non-invasive treatment options. They are either implemented as a stand-alone strategy or with other conservative or supportive therapies and surgical intervention [43,44].

Pelvic floor muscle training (PFMT) involves voluntary contractions of the pelvic muscles in repetition sets. PFMT increases muscular volume, provides structural support to the pelvic structure and aids the sphincteric closure mechanism of the urethra. PFMT program, based on the general principle of strength training, is the treatment mainstay for female stress UI.

Several studies have reported that adherence to PFMT can alleviate stress UI [45]. The standard PFMT protocol, in terms of schedule, number of repetitions, and duration of training, involve one or more sets of exercises on multiple days every week for at least two months. After the initial training period, patients should continue maintenance training to avoid recurrence and maintain the benefits [46].

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Many hypotheses suggest the role of PFMT in preventing UI. Adequate PFMT can help reduce the extent of damage during labor, enhance and augment recovery by improved contraction, and increase muscle memory. Muscles that are conditioned have greater nerve supply and reserve strength, thereby minimizing the loss of muscle function.

The main objectives of a PFMT program are to develop strength to prevent leakage; endurance (ability to hold a contraction; repeat contractions for longer durations); and musculoskeletal structural support for enhanced neuromuscular morphological and physiological functions. Therefore, strength training is widely prescribed for pregnant and postnatal women. The core principle of PFMT is the same as that of resistance training, involving a low frequency of repetitions with heavy progressive overload [47].

Duloxetine is the preferred initial medicinal treatment for postpartum stress UI. Compared to placebo, duloxetine was associated with better quality of life (QoL) and reduced frequency of episodic leakage up to 50% [48].

Favorable hygiene practices and dietary interventions may also help alleviate female stress UI [43]. Weight loss with dietary changes and physical exercise ameliorate stress UI in obese and high-BMI patients [49].

Urethral injection (periurethral and intraurethral bulking injection) is a practical, minimally invasive treatment recommended for uncomplicated postpartum stress UI. Chapple, *et al.* (2005) confirmed the safety and efficacy of injecting bulking agents in any urethral mobility status or urodynamic findings [50].

Surgical treatment

Stress UI can be managed with surgical techniques, such as sub-urethral tapes (i.e., tension-free vaginal sling or tape), transobturator tape, and retropubic colposuspension (Burch procedure by laparotomy or laparoscopy).

Compared to Burch colposuspension, sub-urethral tape is economical and convenient from the patient's perspective. It is, therefore, the first-line surgical recommendation for postpartum stress UI. The retropubic top-down or bottom-up routes provide better results than the transobturator route in case of sphincter deficiency [43].

The sub-urethral tape procedures are either retropubic or transobturator, each with inherent advantages and disadvantages. Further investigations are warranted to investigate the efficacy of modified sub-urethral tape techniques such as mini tapes. The sub-tape procedures requiring local, locoregional, or general anesthesia can be performed in outpatient or inpatient settings, depending on the patient's and surgeon's preferences [51].

A sub-tape procedure should be considered after a thorough deliberation of intraoperative risks, postoperative risks, and treatment failure chances. The French College of Gynecologists and Obstetricians (CNGOF) provides guidelines and information on stress UI for prospective surgery patients [52].

Perioperative complications of performing retropubic surgery include vaginal, urinary, and gastrointestinal tract injuries. The transobturator surgery was associated with a lower incidence of bladder injuries but a greater risk of vaginal perforation.

Postoperative complications with sub-urethral tapes include voiding dysfunction, urinary tract infection, urgency, pain, and vaginal, bladder, or urethral erosion. The transobturator route results in more vaginal erosion than the retropubic route. Thus, patients must be assessed for comorbidities and risk factors before designing surgical and post-surgical interventions for UI [43].

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Conclusion

Women's health practitioners should provide their patients with adequate information, and audio-visual materials, and sources to further clarify postpartum care. Patients must be appraised of the advantages of PFMT during and after pregnancy and methods to perform PFMT. An intervention combining PFMT and an app (application program) can help overcome information barriers and promote preventive, curative, and maintenance benefits of PFMT in women during the last trimester, and those experiencing stress UI within 6 months to one year after delivery.

The severity of stress UI can be objectively assessed by determining the mobility of ureterovesical junction (UVJ-M), rotation angle, and distance from the bladder neck to the lower edge of the pubic bone. A reference standard of UVJ-M > 1 cm can be used as an objective indicator for the ultrasound-guided diagnosis of stress UI. Also, ultrasonography helps identify mutual associations between the various structures of the pelvic floor, reflecting the morphological and functional status.

The predicted threshold values in UVJ-M in women at 34, 36, and 38 gestational weeks, and 6 weeks after delivery demonstrated that the prevalence of stress UI ($\chi^2 = 5.624$, $P = 0.016$) was significantly increased. UVJ-M was also increased during these gestational weeks [53]. Further validation in the postpartum setting can effectively detect the presence of postpartum stress UI based on changes in abdominal pressure. Most studies indicated that vaginal delivery is a significant risk factor for postpartum stress urinary incontinence.

Conflict of Interest Statement

The authors declare that this paper was written without any commercial or financial relationship that could be construed as a potential conflict of interest.

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