Chapter 6
Behavioral Therapy and Lifestyle Modifications for the Management of Urinary Incontinence in Women

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Introduction

Most clinical practice guidelines recommend behavioral therapies as initial treatments for women with urinary incontinence (UI). These interventions vary widely and may include fluid management, dietary changes, avoidance of bladder irritants, timed voiding, bladder training, management of bowel function, exercise, weight loss, and advice regarding absorptive products and skin protection. While the evidence for support of these interventions is often limited, they are generally low-risk and inexpensive. These factors support their inclusion early in treatment algorithms.

Evidence to support these treatments is lacking in many cases because these interventions are difficult to study. Behavioral therapy and lifestyle modification are difficult to standardize and monitor. High-quality prospective interventional studies are rare; thus, much of the literature around this topic is observational in nature. Outcomes tend to be reported for a combination of behavioral interventions, making interpretation of results difficult. Patient compliance represents a challenge as well, as it may be difficult to assess how well patients adhere to behavioral recommendations. Some evidence supports the use of behavioral therapies in conjunction with other treatments. For example, in the multicenter randomized trial BE-DRI, adding behavioral therapy (including bladder training and fluid management, as well as pelvic floor muscle training) to drug treatment in women with urgency-predominant UI had a beneficial effect on patient satisfaction, perceived improvement, and reduction of other bladder symptoms [1].

Guideline documents published by the American Urological Association (AUA), American Urogynecologic Society (AUGS), and American College of Obstetricians

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and Gynecologists (ACOG) all recommend the use of behavioral therapy in the initial treatment of female UI, typically including pelvic floor muscle exercises and training programs in this category [2–4]. High-quality evidence does exist to support the use of pelvic floor muscle exercises and training for both stress and urgency incontinence (see Chap. 7).

In this chapter, we discuss other behavioral treatments for female UI, many of which may be considered lifestyle modifications. In the following sections, we review each behavioral intervention and summarize the available evidence supporting its use for the treatment of female UI and other urinary symptoms. Table 6.1 lists the interventions discussed in this chapter, the patients in whom they may be recommended, and a description of the evidence supporting each one. While it is important to understand what evidence is available related to behavioral treatments for UI, the treatments are generally low-risk and low-cost and may hold other health benefits for women. Thus, they can often be implemented immediately following initial

Table 6.1 Behavioral treatments recommended for urinary incontinence in women

Intervention	Target population	Description of evidence supporting intervention
Dietary modifications	All patients	Weak: inconsistent results from mostly observational studies suggest possible associations between diet and dietary components and urinary incontinence
Fluid management	All patients	Moderate: interventional studies show consistent benefit of fluid restriction for urinary incontinence and overactive bladder
Caffeine reduction	Patients consuming caffeine	Weak: inconsistent results from observational studies support association between caffeine and urinary incontinence; small interventional studies do not show benefit
Alcohol reduction	Patients consuming alcohol	Weak: inconsistent results from observational studies focused on association between alcohol and urinary incontinence
Tobacco cessation	Tobacco users	Weak: observational studies suggest association between tobacco use and urinary incontinence
Timed/prompted voiding	Infrequent voiders	Weak: interventional studies provide inconsistent evidence for benefit
Bladder training	Frequent voiders	Moderate: interventional studies show benefit of bladder training for urinary incontinence
Bowel management	Patients with constipation	Weak: inconsistent results from observational studies support association between constipation and urinary incontinence and other urinary symptoms
Exercise	All patients	Weak: limited interventional studies provide evidence for use
Weight loss	Overweight and obese patients	Strong: high-quality randomized trials show benefit for urinary incontinence
Absorbent products	All patients	Weak: limited interventional studies provide evidence for use
Skin protectants	All patients	Weak: limited interventional studies provide evidence for use

evaluation and prior to invasive or costly testing. Figure 6.1 demonstrates the educational handout we provide to patients after their initial evaluation for UI with instructions and recommendations related to many of these lifestyle modifications.

Things to do to help your bladder problem:

1. Avoid bladder irritants. There are some foods and liquids that may irritate the bladder.

Avoid or reduce these foods and drinks:

- Alcoholic beverages: liquor, wine and beer
- Caffeine: coffee, tea, dark sodas, darker herbal teas and chocolate
- Very acidic fruit or fruit juices: orange, grapefruit, lemon, lime, mango and pineapple
- Artificial sweeteners: Equal and Nutrasweet
- High doses of vitamins
- Carbonated beverages

The best beverage is water.

2. Drink 4–6 oz of fluid (small cup) every 3–4 hours, evenly spaced throughout the day. Limit your total fluid intake to 48–64 oz per day (~6–8 8 oz cups). The goal is pale yellow urine that does not have a strong odor.

3. Urinate by the clock-every 2–3 hours. Don't wait until you feel full or for a more convenient time. Try to relax when voiding. Do not strain or bear down to start a stream or empty your bladder more quickly.

4. Reduce nighttime awakenings to empty your bladder.

- Limit fluid intake after dinner to reduce nighttime urination.
- Avoid swelling in your lower legs by wearing support hose or elevating your legs when resting during the day.

5. Establish regular bowel habits.

Constipation affects bladder control. Dietary fiber supplements, stool softeners, or laxatives (such as Miralax) are options to help keep bowels regular and easy.

6. Watch your weight. Obesity makes bladder control more difficult.

7. If you smoke, here is one more reason to consider a quit plan. Smoking makes leakage worse because of chronic cough and irritation to the bladder.

8. Don't irritate your vulva area. Avoid colored and perfumed toilet tissue and sanitary napkins. Wash with warm water, wear all-cotton underwear, or small urine-loss pads.

Good bladder habits can be developed at any time. Old habits may be hard to break especially when we try to change too many things at once. Start slowly, changing one thing at a time until you become comfortable with your new healthy habits.

Good Luck!

Fig. 6.1 Patient educational handout describing behavioral treatments and lifestyle modifications for urinary incontinence and other urinary symptoms

Diet

Dietary and fluid modifications comprise a large portion of behavioral management of urinary incontinence. Much of the literature surrounding alterations in diet and implications on bladder function use diet as a proxy for weight loss, and this relationship will be further examined in a subsequent section. With regard to specific dietary components and their relationship to stress urinary incontinence, Dallosso et al. [5–7] found that consumption of saturated and monounsaturated fats may increase the risk of stress UI while intake of breads/starches and vegetables may decrease the risk. When looking at specific nutrients, a large epidemiologic study found consumption of both zinc and vitamin B12 was associated with stress incontinence in women [5–7].

Given the identification of estrogen receptors in the urogenital tissues (bladder, urethra, vaginal epithelium, muscles and fascia of the pelvis), the relationship between consumption of food rich in phytoestrogens has been examined with regard to stress UI, overactive bladder (OAB), and lower urinary tract symptoms (LUTS). However, a randomized trial evaluating a diet rich in soy, hypothesized to increase circulating estrogens via phytoestrogens, showed no improvement compared with a control diet in management of overall LUTS or UI [8]. Similarly, Waetjen et al. [9] found no association between the reported dietary intake of three phytoestrogen classes (isoflavones, coumestrol, or lignans) and developing any type of incontinence (stress or urgency) in women transitioning through menopause.

With regard to urinary urgency, frequency, urgency UI and OAB, many of the recommendations surrounding dietary modification involve avoidance of foods that may acidify the urine composition or irritate the bladder, for example, citrus products. In a longitudinal cohort study, Curto et al. [6] found supplemental vitamin C use above recommended daily intake was associated with higher odds of daytime urinary storage symptoms in women, but higher baseline vitamin C intake from foods and beverages was associated with a lower odds of urgency symptoms. Similar results were seen in an observational, population-based, epidemiologic study of 2060 women. In this study, high-dose intake of vitamin C and calcium were positively associated with UI symptoms, whereas vitamin C and β-cryptoxanthin from foods and beverages were inversely associated with voiding symptoms [10]. Overall, these studies suggest that vitamin C supplementation above moderate, absorbable doses (>250 mg/day) may irritate the bladder and should be avoided.

Dallosso et al. [6] reported in a longitudinal study that higher intake of vitamin D ($P = 0.008$), protein ($P = 0.03$), and potassium ($P = 0.05$) was significantly associated with decreased risk of new OAB. These results were not confirmed in a pilot randomized double-blind, placebo-controlled trial of postmenopausal women with urgency UI and vitamin D insufficiency, versus placebo. In this trial, a 43% decrease in urgency UI episodes was seen with 50,000 IU vitamin D3 treatment weekly, but this did not reach statistical significance compared to placebo (where 28% reduction in urgency UI episodes was seen), except in the subset of Black women (who had 63% reduction compared to 23% with placebo) [11]. To further evaluate vitamin D's

involvement in the regulation of detrusor muscle contractions, Markland et al. [12] performed an analysis of nearly 73,000 older and middle-aged women in the Nurses' Health Study I and II and found little evidence of a relationship between vitamin D intake and the development of UI. From a macronutrient level, Dallosso et al. [6] found a reduced risk of OAB onset with higher consumption of vegetables, bread, and chicken.

Most of the research findings related to specific dietary components and UI are epidemiologic and represent associations that may not be causal. Thus, it is difficult to make specific dietary recommendations for the treatment and/or prevention of UI and likely best to advise patients to consume a well-balanced diet to promote general health and wellness.

Fluid and Caffeine Management

Perhaps the most widely recommended behavioral modifications for the management of UI and other urinary symptoms focus on fluid and caffeine management. Both the AUA and AUGS/ACOG recommend fluid management as a first-line behavioral modification [2–4]. Recommendations generally emphasize overall management of volume of fluid consumed and avoidance of irritative fluids, in particular, caffeine. Despite these recommendations and consensus among experts about the importance of fluid management, the literature available is varied. For example, when reviewing the Nurses' Health Study cohorts, Townsend et al. [13], found no association between total fluid intake and risk of incident UI (hazard ratio 1.04, 95% CI 0.98–1.10 comparing top versus bottom quintile of fluid intake). In analyses of incontinence type, total fluid intake was not associated with risk of incident stress, urgency, or mixed incontinence.

With regard to stress UI specifically, Dallosso et al. [6], reported that carbonated drinks were a significant risk factor for the onset of stress UI and OAB in a prospective cohort study. A 4-week randomized, prospective, crossover study aimed to determine the effect of caffeine restriction and change in volume of fluid intake on urinary symptoms in women with stress UI. In this trial, Swithinbank et al. [14] determined that decreasing fluid intake reduced incontinence and frequency episodes when comparing the week of decreased fluids with baseline or the week of increased fluids. There was, however, no increase in incontinence episodes when the week of increasing fluids was compared with baseline. The authors concluded that decreasing fluids improved urinary symptoms, and while women must maintain adequate daily fluid intake to avoid dehydration, they should be advised to drink less fluid to improve symptoms as part of conservative treatment [14].

Studies in patients with OAB and urgency UI generally show a positive association between fluid intake and symptoms [15]. Women experience increased frequency and urgency symptoms with fluid increase and decreased frequency and urgency with fluid reductions. With regard to incontinence specifically, results tend to be more mixed, and in general, most patients have a difficult time adhering to

fluid protocols [15]. In a systematic review of ten interventional and observational studies, Callan et al. [16] reported reducing fluid intake was beneficial in reducing OAB symptoms. These authors also found that increasing fluid intake was associated with worsening OAB symptoms in observational studies but that no difference in symptoms was seen in interventional studies.

Caffeine, which is consumed more than any other stimulant in the world, has diuretic effects and may also affect the bladder by increasing detrusor pressure and promoting detrusor excitability [17]. A significant body of literature has been published regarding the effect of caffeine intake on urinary symptoms and reduction of caffeine is generally considered part of the behavioral management of UI. In several studies, caffeine reduction was associated with reduced urinary frequency, urgency, and OAB quality-of-life scores [15]. And while there is some conflicting literature, a systematic review by Bradley et al. [15] states, "Overall evidence suggests a weak positive association between caffeine and UI, but there are conflicting results for urinary incontinence types."

The Nurses' Health Studies prospectively investigated the association between total caffeine intake (as determined by food frequency questionnaires) and incidence of UI, including stress, urgency, and mixed UI. Over 4 years of follow-up in 65,176 women, a modest, but significantly increased, risk of weekly incontinence was seen among women with the highest versus lowest caffeine intake (RR 1.19, 95% CI 1.06–1.34, comparing >450 vs. <150 mg/day), as was a significant trend of increasing risk with increasing intake (P for trend = 0.01). Higher daily caffeine intake (roughly equivalent to ≥4 cups of coffee or ≥10 cups/cans of caffeinated tea or soda per day), but not lower levels, was associated with a modest increased risk of urgency UI in women [18]. When examining the Nurses' Health Studies longitudinally, longer-term caffeine intake was not associated with risk of UI progression over 2 years among women with moderate incontinence [19].

The National Health and Nutrition Examination Survey, a cross-sectional national representative survey, found that caffeine intake in the highest quartile (204 mg/day) was associated with any UI (prevalence odds ratio (POR) 1.47, 95% CI 1.07–2.01), but not moderate/severe UI (POR 1.42, 95% CI 0.98–2.07). Authors concluded moderation of caffeine intake remains a reasonable part of the multicomponent treatment for UI [17]. Similarly, Maserejian et al. [20] found that women who increased coffee intake by at least 2 servings per day compared with categories of decreased or unchanged intake had 64% higher odds of progression of urgency (P = 0.003). Women with recently increased soda intake, particularly caffeinated diet soda, had higher symptom scores, urgency, and LUTS progression. These findings support recommendations to limit caffeinated beverage intake. In a small cystometric study, caffeine intake of 4.5 mg/kg 30 min prior to examination caused diuresis, a lower threshold of sensation during filling, and increased flow rate and voided volume, suggesting caffeine can promote early urgency and frequency [21]. There may be a dose-dependent positive relationship between caffeine intake and OAB [22].

A question which remains is whether general fluid restriction or caffeine restriction specifically is of greater consequence for women with UI. Zimmern et al. [23]

suggested that general fluid management instructions (intake of 50 to 70 ounces of liquid per day) can contribute to the reduction of urgency UI symptoms for women taking anticholinergic medications, but additional individualized instructions along with other behavioral therapies did little to further improve outcomes. Segal et al. [24] found a significant relationship between quartiles of total fluid intake and increasing number of daily voids ($P < 0.001$) and quartiles of caffeinated fluid intake and increasing severity of urgency UI ($P = 0.038$). The type and volume of fluid intake were significantly associated with symptoms of urinary frequency and urgency UI. They concluded consumption of increasing amounts of total fluid was significantly associated with urinary frequency, and intake of large amounts of caffeinated fluids was associated with urgency UI.

Conversely, two small randomized trials did not find a benefit to caffeine restriction over general fluid reductions for UI. A small randomized, crossover study tested caffeine restriction as well as fluid intake changes in women with stress and urgency UI and found changing from caffeinated to decaffeinated beverages had no impact on symptoms, while overall fluid intake reductions resulted in reduced frequency and incontinence episodes [14]. Lastly, Schimpf et al. [25] completed a randomized trail designed to test the common clinical advice of treating OAB by eliminating potentially irritating beverages (those including caffeine, artificial sweeteners, citrus, and alcohol) while keeping volume of intake stable. The authors reported that reduction in intake of potentially irritating beverages did not result in reduced voiding frequency compared to a control group [26]. Urgency symptoms and bother scores were also unchanged. Together, current evidence suggests that reducing potentially irritating beverage intake (including caffeinated beverages) may be less influential than reducing total fluid intake volume for UI and OAB symptoms.

Alcohol and Tobacco

Alcohol consumption has also been examined as a modifiable behavior in the management of UI given its sedative effects, ability to impair mobility, and diuresis [27]. A systematic review published in 2017 reports there is limited information and inconsistent results related to alcohol and urinary symptoms [15]. Whereas alcohol may impact urgency and frequency symptoms among current drinkers, findings are inconsistent by intake level and symptom subtype. No association was found between type of UI and alcohol intake [15].

Tobacco use and its effect on LUTS have also been examined, and smoking cessation remains a recommended behavioral modification for the management of urinary symptoms. Some studies provide evidence of a positive association between tobacco use and stress [28, 29], urgency and mixed incontinence [30], and incontinence of any (unspecified) type [30–32]. Six studies found no association, and one found a negative association between occasional UI and current smoking [15]. Hannested et al. [31] showed mixed results between current, former, and heavy

smoking and various measures of incontinence. Former and current smoking was associated with incontinence, but only for those who smoked more than 20 cigarettes per day. Severe incontinence was weakly associated with smoking regardless of number of cigarettes.

Dallosso et al. [6] found a significant association between smoking and risk of OAB with current smokers 1.44 times more likely to develop OAB than nonsmokers. Within the broad category of evidence for OAB or LUTS in general (rather than incontinence specifically), there are some consistent and some inconsistent findings. A small amount of evidence suggests former and/or current smoking is related to frequency in women. Two studies showed a positive association between urgency and current tobacco use [33, 34], while two did not [35, 36]. Maserejian et al. [37] found that women smokers were twice as likely to develop LUTS, particularly storage symptoms (OR = 2.15, 95% CI: 1.30–3.56, P = 0.003), compared to never-smokers and recommended smoking cessation.

Single studies showed a positive association between smoking and women's maximum cough spike [28], cough leak point pressure, and maximal intravesical pressure generated by cough [38]. The two studies that examined severe UI showed a positive association [15]. Taken together, research suggests a relationship between tobacco and urinary symptoms may be present. Although not definitive, given the additional health benefits to smoking cessation, it is reasonable to include this among behavioral recommendations for UI.

Timed Voiding

In addition to modification of fluid intake, a common behavioral modification for the management of UI is timed or prompted voiding. The goal of this modification unlike bladder training (described below) is not to increase time between voids, voided volume, or bladder capacity, but rather to encourage regular bladder emptying in order to reduce UI that more often happens at higher bladder volumes [39]. Most evidence related to this practice is for "prompted voiding," a type of timed voiding frequently used in patients with cognitive dysfunction and in assisted-living situations, where a caregiver or family member prompts a patient to void at a regular interval.

In a review of nine trials examining 674 patients (mostly women) comparing prompted voiding to unprompted voiding, there was limited evidence whether either approach had improved incontinence [40]. Authors theorized that an increase in prompted voids decreased incontinent episodes in the short term. In a more recent Cochrane review examining fixed interval or timed voiding for the management of UI in elderly women with reduced cognition and impaired mobility, two trials consisting of 298 women provided insufficient evidence supporting this treatment. However, given the low risk of potential harm and the high likelihood of risk (such as medication side effects) in this population from other treatments, prompted voiding was still deemed a reasonable treatment option [41]. Alternatively,

Holroyd-Leduc et al. [42] reported that several randomized trials examining the role of prompted voiding initiated by a caregiver revealed better outcomes than usual incontinence-related care (including regular checking and changing of wet garments and bedding).

While evidence is lacking, most experts recommend timed or scheduled voiding for patients with urgency UI and OAB, particularly in those who do not report significant frequency, or whose bladder diaries suggest longer voiding intervals or incontinence that regularly occurs just prior to voids.

Bladder Training

Bladder training is a behavioral therapeutic strategy which encourages patients with urgency and frequency symptoms, as well as mixed and stress UI, to gradually increase the amount of time between voids, thereby increasing their bladder capacity and potentially reducing leakage and the sensation of urinary urgency [39]. This technique was first described in 1966, and patients were initially instructed to void at a set interval of every 1–2 h. According to the severity of their symptoms, the interval between voids was increased by half-hour increments until 3.5 h was achieved [43]. Bladder training generally requires intact cognition, highly motivated patients, and a fixed voiding schedule, regardless of a sense of urge to void. Exact training techniques vary between studies, but all involve strategies to increase the time interval between voids progressively. In the protocol for the ESTEEM trial, bladder training was described as a "multicomponent intervention that involved patient education regarding lower urinary tract function, setting incremental voiding schedules, and teaching urge control techniques to postpone voiding and adhere to a schedule" [44].

In 1996, Davies et al. [43] performed an inpatient study of 50 consecutive patients with urinary frequency, urgency, and urgency incontinence. At the time of discharge, they reported that 80% of women were subjectively cured and satisfactorily improved. However, this success deteriorated to 32% in patients who replied to a postal survey 12–29 months later. Echoing the difficulty in maintaining a rigorous voiding schedule, Visco et al. [45] concluded bladder training success in the real world may be substantially lower than described in intensive clinical trials as 55% of study subjects never started bladder training or were noncompliant with treatment. Newman et al. [44] reported that randomized trials using intention-to-treat models show a mean reduction in UI of 60–80% after bladder training. A Cochrane review in 2004 reported that bladder training may help people who are physically and mentally able to use this method, but it may take months to achieve results [46]. Authors tentatively concluded that the limited evidence suggested bladder training may be helpful for the treatment of UI; this recommendation was tempered because the trials had variable quality and small size and thus results were less certain [46].

One study examined changes in urodynamic parameters following bladder training, and no measurable change was identified. Based on this, Elser et al. [47]

concluded the mechanism by which clinical improvement occurs remains unknown. Possible mechanisms for the effectiveness of bladder training include (1) improving central control over bladder sensations and urethral closure and/or (2) changing an individual's behavior in ways that increase the lower urinary system's "reserve capacity" as knowledge of circumstances that cause bladder leakage is gained [44]. Patients with UI, particularly with urgency, often void frequently to avoid this symptom. This behavior can lead to a reduction in functional bladder capacity, which in turn may perpetuate urgency symptoms.

Many investigators have examined bladder training together with other management strategies for the treatment of UI. For example, Mattiasson et al. [48] reported the median percentage reduction in voiding frequency was greater in patients taking tolterodine and performing bladder training than in patients taking tolterodine alone (33% vs 25%, $P < 0.001$). The combined therapy group also had a larger median percentage increase in volume per void (31% vs 20% $P < 0.001$). Wyman et al. [49] examined whether bladder training, pelvic muscle exercises with biofeedback, or combination therapy was more beneficial for the treatment of UI and found combination therapy had the greatest immediate efficacy in management regardless of urodynamic diagnosis. However, at 3 months following treatment, all three interventions had similar results, suggesting the specific treatment may not be as important as a structured intervention program. In a Cochrane review, authors reported there was not enough evidence to determine whether bladder training was useful as a supplement to other therapies [46].

Benefits of voiding strategies, including both timed or prompted voiding and bladder training, include their minimal risk, low cost, and potential efficacy for all UI types (stress, urgency, and mixed). Thus, they remain an ideal first-line therapy and should be considered prior to more invasive and/or costly diagnostic testing or therapeutic measures.

Bowel Management

A common behavioral recommendation for the treatment of UI and other LUTS is the management/regulation of bowel function. The co-occurrence of constipation with urinary symptoms is well established in the pediatric population, called dysfunctional elimination syndrome [50, 51]. In fact, treatment of constipation relieved 90% of daytime incontinence in children and eliminated the recurrence of urinary tract infections [50]. While this link is not as well established in adult women, the literature generally supports the theory that normal bowel function contributes to normal bladder function. In a secondary analysis of 2812 community-dwelling women, Cameron et al. [52] found that women with defecation difficulties had an increased rate of LUTS [52]. Specifically, women with difficult defecation were more likely to experience nocturia (mean 1.8 ± 0.1 vs. 1.3 ± 0.0), urgency (47.6 vs. 29.2%), increased daytime frequency (mean 8.2 ± 0.3 vs. 7.2 ± 0.1), dysuria (22.9% vs. 13.7%), and a sensation of incomplete bladder emptying (55.6% vs. 28.2%).

The exact pathophysiology of the relationship between bladder and bowel function remains somewhat unclear. One proposed mechanism is that delaying fecal evacuation requires contraction of the external anal sphincter and puborectalis until fecal urgency subsides. If this behavior is maintained over time, the rectum becomes overdistended and the pelvic floor musculature hypertonic, which itself contributes to the development of urinary symptoms [53]. Additionally, a full rectum and sigmoid may exert extrinsic pressure on the bladder, decreasing functional capacity or possibly stimulating the stretch receptors of the bladder wall, triggering a detrusor contraction [53, 54]. Finally, it is also possible that signals related to defecation dysfunction occurring in shared neurologic pathways in the spinal cord or pelvic nerves may lead to alterations in the central nervous system regulating bladder function [55]. The theory of a common neurologic pathway impacting function (or dysfunction) in both organs is supported by the success seen in treatment of both bowel and bladder symptoms via sacral nerve stimulation with identical lead placement in the S3 foramina [56].

While further studies are needed to confirm that treatment of bowel symptoms in adult women improves bladder symptoms, these measures remain part of initial treatment recommendations and are certainly not harmful. Most often, this involves recommending a bowel regimen for constipation, such as regular use of stool softeners, fiber supplements, or laxatives, tailored to the individual patient's condition and symptoms. Women with bothersome LUTS should be asked about defecatory symptoms, and these should be addressed concurrently given their likely interrelation.

Exercise

Most evidence related to the use of exercise to manage UI involves exercise programs to achieve weight loss and thus improve incontinence symptoms. However, research also suggests that individuals who describe themselves as less active than others of the same age are more likely to develop stress incontinence, and a low physical activity level has been significantly associated with an increased risk of development of OAB [6]. Alternatively, at the other extreme, women who participate in high-intensity physical activities such as powerlifting or CrossFit may experience higher rates of UI [57–59]. These women report using preventative measures for protection from incontinence during exercise, such as emptying their bladder before workouts, wearing dark-colored pants, and performing Kegel exercises during workouts [59].

The use of pelvic floor muscle exercises for the treatment of UI is reviewed in Chap. 7. However, several studies have examined the performance of a modified Pilates or yoga programs which incorporate pelvic floor strengthening to improve compliance and motivation to complete a pelvic floor exercise regimen. Hein et al. [60], in a 12-week pilot study, proposed that the performance of a pelvic floor strengthening Pilates program may be beneficial given the difficulty to maintain a

pelvic floor routine in isolation. They reported improved incontinence scores and high levels of compliance with the program. Similarly, in a pilot randomized trial, Lausen et al. [61] reported benefit in making pelvic floor muscles exercises part of a modified Pilates class to increase motivation in performing these exercises. Lastly, weight training in combination with pelvic floor muscle training provided earlier improvement in UI compared with pelvic floor muscle training alone in a small randomized trial of elderly women with stress UI [62].

In a single-center randomized pilot trial, Huang et al. [63] found that community-dwelling women with UI were successful in implementing a yoga-based intervention through group classes and home practice. Women who completed the 3-month yoga program saw an average of 76% reduction in frequency of incontinence, while women who completed a time-equivalent muscle stretching and strengthening program saw a 56% decrease. They concluded that yoga has the potential to provide community-based management of UI in women, although unclear if this is superior to other physical activity. Despite these promising studies, a recent Cochrane review concluded that the role of yoga or a modified Pilates regimen for the management of UI remains uncertain, as most trials are small and at high risk of bias [64].

Weight Loss

Obesity is a serious public health concern with implications on many aspects of a woman's life, including continence. Obesity is a well-established risk factor for the onset of stress UI [6]. In fact, across adult life, higher body mass index (BMI) for women is linked with symptoms of stress and severe incontinence. Women who are overweight or obese since their early adult life have more than double the risk of severe incontinence [65]. It is therefore important to encourage women to maintain a normal weight at all ages both as a means of preventing the development of incontinence and as a means of management of incontinence after it presents.

The association between obesity and urgency UI is not as well-understood, but the mechanism of action linking obesity and stress UI is likely the positive relationship between BMI and abdominal circumference and several urodynamic measures. Richter et al. [66] demonstrated incremental increases in intra-abdominal pressure and intravesical pressure with increasing BMI or abdominal circumference in an overweight and obese cohort with stress UI. With increasing weight women appear to move closer to their continence threshold during stress events. Fuganti et al. [38] demonstrated that obese women had higher maximal intravesical peak pressures with cough, compared to women with lower BMI. These studies suggest that weight loss may reduce incontinence by reducing intravesical pressures during cough and other activities.

The impact of weight loss on UI was demonstrated in the landmark Program to Reduce Incontinence by Diet and Exercise (PRIDE) trial [66]. In PRIDE, overweight and obese women with at least ten UI episodes per week were randomized

to a 6-month weight loss program or to a structured education program. At 6 months, the intervention group had a mean weight loss of 8% (7.8 kg) and experienced a 47% decrease in mean weekly incontinence episodes, as compared with the control group who had a weight loss of 1.6% (1.5 kg) and a 28% reduction of incontinence episodes ($P = 0.01$). The intervention group also had a greater reduction in frequency of stress UI episodes, but not urgency incontinence episodes, compared to the control group. The authors concluded that behavioral weight loss intervention reduced the frequency of self-reported UI episodes among overweight and obese women [67].

The link between weight loss and improvement in UI was maintained in the PRIDE study population through 18-month follow-up [67]. At 12 months, the intervention group reported a greater percent reduction in weekly stress UI episodes (65% vs 47%, $P < 0.001$), and a greater proportion achieved at least a 70% decrease in weekly total and stress UI episodes compared to baseline. At 18-months, a greater proportion of women in the intervention group had more than 70% improvement in urgency incontinence episodes as well, but the differences between the groups for improvement in stress and total UI episodes were not significant. The authors concluded weight loss intervention reduced both the frequency of stress incontinence episodes through 12 months and improvement in patient satisfaction with regard to incontinence through 18 months [68].

While falling outside of the realm of behavioral modifications, weight loss that is the result of bariatric surgery has also proven to improve UI in obese women. Several studies have supported that weight loss after bariatric surgery improved clinically significant UI [69–71], and this improvement appears to be maintained from 1 to 5 years following bariatric surgery [72, 73].

The AUGS Systematic Review Group studied the impact of weight loss intervention on LUTS and UI in overweight and obese women [74]. They identified high-certainty evidence that behavioral weight loss decreases the prevalence of stress UI 15% to 18% and overall UI 12% to 17% at 1 to 2.9 years. This improvement is seen after a 5% to 10% reduction in body weight with further weight loss having minimal additional benefit. The certainty of evidence on the long-term impact of these interventions was lower: the effect seems to diminish over time, which may be attributable to weight re-gain. The certainty of the evidence was moderate to low regarding the benefit of behavioral weight loss on urgency UI and OAB symptoms. No randomized trials evaluated the impact of surgical weight loss on urinary symptoms, and the level of evidence on this matter was low [74].

Absorbent Products and Skin Protection

For women who continue to experience UI despite treatment, absorbent products and skin protection are important to maintain quality of life and avoid incontinence-associated dermatitis. About 9% of the annual cost of incontinence treatment is for

absorbent products [75, 76], and 87% of community-living women 60 years and older use pads to manage their incontinence [77]. These products need to be dependable and inconspicuous [77, 78]. Women obtain information about such products from many sources but most ultimately resort to a trial-and-error approach to product selection. Thus, healthcare providers should provide information about absorbent products during their assessment of incontinence [79].

Women who experience mild UI can select from four main designs of absorbent products: disposable insert pads, disposable menstrual pads, washable undergarments with an integral pad, and washable inserts [80]. A Cochrane review found limited data comparing these products but concluded based on one eligible study that for leakage prevention, overall acceptability, and preference, disposable inserts are better than menstrual pads, which are better than washable undergarments with integral pads, which are better than washable inserts. There was no clear difference with regard to skin health between washable or disposable options. Most women prefer disposable pads, but these are often the more expensive option [80].

Women who experience moderate to heavy incontinence, based on a Cochrane review with two eligible trials, may benefit most from disposable "pull-up" style products, despite the expense. Disposable inserts are a cheaper alternative but may not provide as much protection. Again, no particular design seemed better or worse for skin health. Ultimately, women have different options and preferences for absorbent product design and using a combination of options may be most suitable and cost-effective [81].

Consideration should also be given to cleaning, moisturizing, and protecting the vulvar and perineal skin for incontinent women. Incontinence-associated dermatitis, ranging from redness, swelling, oozing, crusting, and scaling changes to loss of skin integrity, occurs when urine (or stool) is in contact with the skin [39]. Secondary infections may occur, such as topical candidiasis. To avoid such complications, a skin care regimen should be recommended for patients with incontinence. A skin care regimen involves cleansing after each incontinence episode with a perineal cleanser (not bar or hand soap), moisturizing (with glycerine, lanolin, or mineral-oil), and application of a moisture barrier (e.g. petrolatum, lanolin, zinc oxide) to shield against irritants and moisture [39].

Limited studies have examined skin care products for the prevention of incontinence-associated dermatitis in adults [82]. In a review by Pather et al. [83], the authors concluded skin care regimens that include the use of a topical barrier product are beneficial in preventing and treating dermatitis related to UI, but there was no evidence to indicate superior outcomes from any specific product. Another systematic review suggested that perineal skin cleansers may be effective at preventing incontinence-associated dermatitis and maintaining skin barrier function compared to traditional soap and water [84]. Regardless of the limited evidence, a regimen to clean, moisturize, and protect vulvar and perineal skin for women who experience incontinence is an important aspect of incontinence care.

Conclusion

A wide variety of behavioral and lifestyle modifications are recommended as initial treatments for women with UI. The evidence base supporting these recommendations is overall weak and largely observational in nature, with few randomized trials contributing to this area.

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