

# Urinary incontinence in women

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## Introduction

Urinary incontinence in women is a common and costly problem. Many treatment options are available, from simple lifestyle modifications to invasive surgery. This review describes the most common types of urinary incontinence, appropriate clinical investigations, and the treatment options available. Recent advances, including new pharmacologic and surgical therapies, have reshaped the treatment of incontinence. Overall, level I evidence supports the use of these treatments, and clinicians have a wide range of treatment options to choose from.

## Epidemiology and prevalence

The International Continence Society defines urinary incontinence as any involuntary leakage of urine.<sup>1–2</sup> Urinary incontinence is estimated to affect 200 million people worldwide.<sup>3</sup> The prevalence of urinary incontinence in women is variable in the literature, but it is reported to be as high as 55%.<sup>4</sup> This number may be an underestimate, because up to half of women may fail to report urinary incontinence to their healthcare provider.<sup>5</sup> This may be due to embarrassment, lack of knowledge about treatment options, or a belief that urinary incontinence is a normal inevitable part of aging.<sup>6</sup>

According to the 2010 International Urogynecological Association (IUGA)/International Continence Society (ICS) joint report, stress urinary incontinence is defined as voluntary loss of urine on effort, physical exertion, or on sneezing or coughing.<sup>2</sup> Depending on age, the prevalence of stress incontinence ranges from 29% to 75%, with a mean of 48%.<sup>7</sup> The prevalence of daily stress urinary incontinence is 10% in community dwelling middle aged women.<sup>8</sup> A third of women with stress urinary incontinence report leakage weekly.<sup>8</sup>

Urgency urinary incontinence is defined as the involuntary loss of urine associated with urgency.<sup>2</sup> Urgency incontinence is part of a larger symptom complex known as overactive bladder syndrome, which is defined as urinary urgency, usually accompanied by frequency and nocturia, with or without urgency urinary incontinence, in the absence of urinary tract infection or other obvious disease.<sup>2</sup> The National Overactive Bladder Evaluation (NOBLE) study, in which investigators conducted telephone interviews with more than 5000 adults, with a follow-up nested study, found the prevalence of overactive bladder syndrome to be 16.9% in women and 16% in men.<sup>9</sup> People with overactive bladder syndrome-dry (without leakage) have frequency and urgency without leakage, whereas people with overactive bladder syndrome-wet (with leakage) experience overactive bladder syndrome with urgency urinary incontinence. The overall prevalence of urgency urinary incontinence is estimated at 7–33%.<sup>7</sup> Women are more likely to experience urgency urinary incontinence (overactive bladder syndrome-wet)

## SOURCES AND SELECTION CRITERIA

In November 2013, we searched PubMed and the Cochrane databases using the keywords “female urinary incontinence”, “stress urinary incontinence”, “urgency urinary incontinence”, “mixed urinary incontinence”, “overactive bladder”, “pelvic floor muscle training”, “tibial nerve stimulation”, “percutaneous sacral nerve modulation”, “suburethral bulking agents”, and “midurethral slings”. For individual sections, further keywords related to the overall subjects were searched in the same databases. For example, “mirabegron for overactive bladder”, “cost of urinary incontinence”, or “behavioral modification for stress urinary incontinence”. We searched for published guidelines on the American Urological Association, American Urogynecologic Society, Society of Urodynamics, Female Pelvic Medicine and Urogenital Reconstruction, and National Institute for Health and Care Excellence websites. We considered all clinical trials and review articles published in English. We prioritized randomized controlled trials, systematic reviews, and meta-analyses.

than men, with 9.3% of women experiencing this condition versus 2.6% of men.<sup>9</sup> The prevalence of mixed urinary incontinence (both stress urinary incontinence and urgency urinary incontinence) ranges from 14% to 61%.<sup>7</sup>

## Socioeconomic burden

The burden of urinary incontinence is high in both human and financial terms.<sup>10</sup> Urinary incontinence has a negative impact on health related quality of life (HRQOL),<sup>11</sup> and it contributes to depression,<sup>12–13</sup> falls,<sup>14</sup> and admission to a nursing home.<sup>15</sup> The adjusted risk of nursing home admission with urinary incontinence is 2.0 for women and 3.2 for men.<sup>15</sup> The total annual cost of urinary incontinence in the United States is estimated to be as high as \$32bn (£18.7bn; €23.5bn).<sup>16</sup> Furthermore, costs for women over the age of 65 years are twice those for their younger counterparts.<sup>17</sup> The cost of overactive bladder syndrome in the US alone has been estimated at \$65.9bn.<sup>18</sup> Although costs of care include medical care and treatment, the largest contributor for urinary incontinence is the cost of pads, diapers, and bedding.<sup>10–17</sup>

## Risk factors

Established risk factors vary by type of urinary incontinence.

## Pregnancy and childbirth

Pregnancy and childbirth are established risk factors for stress urinary incontinence.<sup>19</sup> Although vaginal delivery and caesarean delivery increase the risk of stress urinary incontinence, the risk is higher in women who deliver vaginally. In a study of more than 15 000 women, the prevalence of urinary incontinence among nulliparous

women was 10.1%, versus 15.9% in the caesarean delivery group and 21% in the vaginal delivery group.<sup>20</sup> This may be due to a combination of injury to the pelvic floor musculature and connective tissue, as well as nerve damage as a result of pregnancy and labor.

**Hysterectomy**

Hysterectomy has been associated with the development of urinary incontinence,<sup>21 22</sup> particularly stress urinary incontinence.<sup>19</sup> Hysterectomy may damage the muscles of the pelvic floor and lead to incontinence, although this is poorly understood. Stress urinary incontinence has also been associated with vaginal prolapse, including cystocele (prolapse of the bladder), rectocele (prolapse of the rectum),<sup>23</sup> uterine prolapse,<sup>24</sup> and vaginal vault prolapse after hysterectomy, probably from the common risk factor of the weakening of the pelvic floor muscles. Weakening of the structures of the pelvic floor can contribute to both prolapse and incontinence, and the two problems may be inter-related because they often share a common cause.<sup>25</sup>

**Other risk factors**

Recurrent urinary tract infection is independently associated with urgency urinary incontinence and is a readily treatable cause of this condition.<sup>26</sup> Higher body mass index<sup>21 24</sup> and advancing age<sup>27</sup> are associated with both stress and urgency urinary incontinence. Family history is important because women whose mothers or older sisters are incontinent are more likely to develop stress and mixed urinary incontinence.<sup>28</sup>

Smoking has been associated with urgency urinary incontinence in women,<sup>29</sup> possibly because of the irritative effects on the bladder. Smoking is also associated with chronic cough, which can contribute to stress urinary incontinence.<sup>30</sup> Caffeine has a diuretic effect and may also play a role in urgency urinary incontinence.<sup>31</sup> A cross sectional national survey of more than 4300 women found that daily caffeine intake of greater than 204 mg (roughly the amount of caffeine in one cup of coffee) was

**Box 1 | Levels of evidence for urinary incontinence risk factors<sup>33</sup>**

- Level 1**
- Pregnancy, labor, and vaginal delivery
- Body mass index
- Genetics and family history
- Oral estrogen
- Level 2**
- Physical function
- Diabetes
- Hysterectomy
- Dementia and loss of cognitive function
- Level 3**
- Smoking
- Caffeine
- Constipation
- Urinary tract infections
- Depression
- Exercise

**Box 2 | Evaluation of women with urinary incontinence<sup>25 34 35</sup>**

**History**

- Urinary symptoms (frequency, urgency, hematuria, urinary tract infections, nocturia)
- Presence of stress urinary incontinence, urgency urinary incontinence, or mixed urinary incontinence
- Pad usage
- Daily fluid intake
- Presence of a vaginal bulge

**Physical examination**

- Pelvic examination: assess for atrophy, prolapse, ability to perform Kegel exercises
- Stress test for stress urinary incontinence
- Presence of edema in the lower extremities
- Cognitive status
- Neurologic examination

associated with a prevalence of 40% of any type of incontinence, most commonly stress urinary incontinence.<sup>32</sup> Many other factors increase the risk of urinary incontinence, and box 1 provides a summary of the levels of evidence for all established risk factors.

**Evaluation**

Because of the lack of self reporting and the high incidence of urinary incontinence and bother, it could be argued that all women presenting to their primary care physician should be screened for symptoms of urinary incontinence.<sup>34</sup> However, professional organizations, such as the US Preventive Services Task Force (USPSTF) and the American Urological Association (AUA), provide no specific screening recommendations, and many women experience leakage that is infrequent and do not seek medical attention. Hence, screening for urinary incontinence is likely to be of maximum benefit to women whose quality of life is affected by urinary incontinence (box 2).

**History**

The investigation of a patient with urinary incontinence should begin with a specific history. Associated urinary symptoms such as frequency, urgency, hematuria, recurrent urinary tract infections, and nocturia should be elucidated and explored. To tailor treatment to the individual, it is necessary to determine whether symptoms of stress, urgency, or both types of incontinence are present.<sup>34</sup> Symptom severity can be assessed by inquiry about daily pad usages, including pad size (pantiliner v menses pad v incontinence pads or diapers). It is important to ask about fluid intake because many women exacerbate symptoms by drinking six to eight glasses of water a day, regardless of thirst.<sup>34</sup> Symptoms of a vaginal bulge may indicate pelvic organ prolapse, which is highly associated with stress urinary incontinence and can also contribute to urgency urinary incontinence.<sup>25</sup>

**Questionnaires**

Several validated tools are available to assess the severity of urinary incontinence and measure condition specific HRQOL. The urogenital distress inventory (UDI-6) and the

incontinence impact questionnaire (IIQ-7) encompass the urinary domain components of the pelvic floor distress inventory-short form (PFDI-20) and the pelvic floor impact questionnaire short form (PFIQ-7). They are popular questionnaires among specialists and measure symptom severity and impact on HRQOL, respectively.<sup>36</sup>

Although no specific questionnaires are endorsed by professional societies in the US, the National Institute for Health and Care Excellence (NICE) recommends the use of:

- The international consultation on incontinence questionnaire (ICIQ)
- The Bristol female lower urinary tract symptoms questionnaire (BFLUTS)
- The incontinence quality of life questionnaire (I-QOL)
- The stress and urge incontinence and quality of life questionnaire (SUIQQ)
- The urinary incontinence severity score (UISS)
- The stress-related leak, emptying ability, anatomy, protection, inhibition, quality of life, mobility and mental status quality of life index (SEAPI-QMM)
- The incontinence severity index (ISI)
- The king's health questionnaire (KHQ).<sup>35</sup>

A systematic review by the symptom and quality of life committee of the International Consultation on Incontinence confirms the use of these questionnaires, all with a grade A recommendation.<sup>37</sup>

#### Bladder diary

A bladder diary can be useful for quantifying symptoms and recording the number and type of episodes of urinary incontinence, and these diaries are recommended by both the AUA and the Society of Urodynamics, Female Pelvic Medicine and Urogenital Reconstruction (SUFU).<sup>38 39</sup> A bladder diary will also record the voiding times and exact voided volumes (recorded by a “hat” placed in the toilet).<sup>40</sup> NICE guidelines also recommend the use of bladder diaries in the initial assessment of women with urinary incontinence or overactive bladder syndrome.<sup>35</sup> Women should complete the diary for a minimum of three days to cover variations in their daily activities, although a two day diary may be more feasible for patients to complete.<sup>35</sup> However, bladder diaries are not always needed when the severity and type of urinary incontinence are readily ascertained from the history.

#### Physical examination

Pelvic examination will identify the presence of associated pelvic organ prolapse, as well as a woman's ability to initiate voluntary contraction of her pelvic floor muscles (the “Kegel” exercise).<sup>34</sup> The ability to contract the pelvic floor muscles should be confirmed on pelvic examination before initiating pelvic floor muscle training for treatment.<sup>35</sup> This can be done by asking the patient to squeeze her vaginal muscles around the examining finger.

A cough stress test with a comfortably full bladder will identify the presence of stress urinary incontinence in most cases. The stress test is performed by asking the patient whose bladder is comfortably full to cough in the supine or lithotomy position. The test is positive if clinical

stress leakage—defined as involuntary leakage from the urethra synchronous with effort or physical exertion, or on sneezing or coughing—is observed.<sup>2</sup> If leakage is not seen on a supine stress test, it may be repeated in the standing position. However, this test is limited, because 34% of women with genuine stress incontinence have a negative stress test at the time of evaluation.<sup>41</sup>

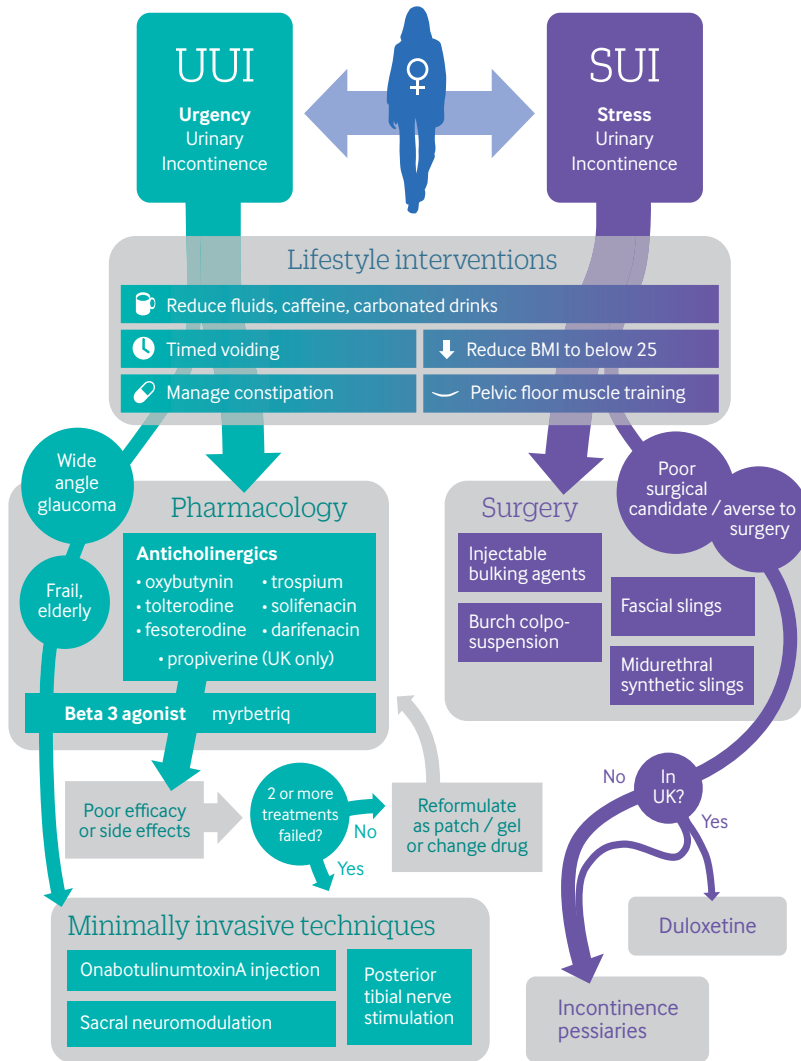
It is also important to identify lower extremity edema (to determine possible sources of polyuria in a patient with nocturia) and overall cognitive status, and to perform a neurologic examination. Urine analysis should be performed in all patients to assess for microhematuria, glucose, protein, leucocytes, and nitrites, and to rule out infection as an acute cause.<sup>35</sup> When indicated, a urine culture is performed. Uroflow (measured flow rate), commonly performed in urologists' and urogynecologists' offices, is useful only for women with signs of voiding dysfunction.<sup>34</sup> Measurement of post-void residual volume, by ultrasound or catheterization, will assess a patient's ability to empty the bladder, and should be performed in women presenting with voiding difficulty or recurrent urinary tract infection.<sup>34 35</sup>

#### Cystometry

Patients with uncomplicated stress or urgency urinary incontinence generally do not require cystometry before starting conservative treatment, including drugs, unless they have microhematuria or other complicating factors, such as previous incontinence surgery or recurrent urinary tract infections. A multicenter randomized non-inferiority trial of 630 women showed no benefit of performing urodynamics over office evaluation alone in patients with straightforward stress incontinence before sling surgery.<sup>42</sup> Treatment was successful in 76.9% of the urodynamic testing group versus 77.2% of the office evaluation group, with a non-inferiority margin of 11%.<sup>42</sup> Treatment success was defined as a 70% or more reduction in the baseline score of the urogenital distress inventory and a patient global impression of improvement response of “much better” or “very much better” at 12 months.<sup>42</sup> However, women with a history of anti-incontinence surgery, planned surgery for pelvic organ prolapse, urge predominant incontinence, and neurologic disease were excluded, which limits the generalizability of the study results to patients with more complex needs.

A second multicenter diagnostic cohort non-inferiority randomized controlled trial (RCT) of 126 women with urodynamic findings discordant with clinical assessment randomized women to immediate surgery or tailored treatment based on urodynamics.<sup>43</sup> It concluded that urodynamics should not be routinely used before midurethral sling surgery because immediate surgery was non-inferior to treatment based on urodynamic findings, with non-inferiority defined as less than a five point difference on the urogenital distress inventory.<sup>43</sup>

Urodynamics should not be performed in women with untreated symptoms or urgency incontinence who have no evidence of neurologic disease or voiding dysfunction.<sup>34</sup> AUA/SUFU guidelines discourage the use of urodynamics in the initial workup of the uncomplicated patient.<sup>38</sup> However, it is often helpful in patients with



Treatment options available for urinary incontinence in women. For full details of drug treatments for urinary incontinence and overactive bladder syndrome, treatment of drug refractory urgency urinary incontinence and overactive bladder syndrome, and treatment of stress incontinence, see the full version of the review on thebmj.com.

mixed symptoms who could benefit from further specific delineation of the cause of their urinary incontinence.

Cystometry is also useful before starting more invasive treatment for drug refractory overactive bladder syndrome. NICE guidelines advocate the use of filling and voiding cystometry in women with suspected detrusor overactivity, voiding dysfunction, anterior prolapse, or in those who have had surgery for stress incontinence.<sup>35</sup> If the diagnosis is still unclear, video urodynamics can be considered.<sup>35</sup> Many specialists prefer video urodynamics as part of routine urodynamics because it provides important anatomic information about the appearance of the bladder and bladder neck (often open in women with stress urinary incontinence).

**Initial management**

Urinary incontinence can successfully be managed initially at the primary care level in most patients. Referral to a specialist is usually indicated when conservative measures fail to improve symptoms. Specialists include

urologists and gynecologists with experience in treating urinary incontinence. The figure shows the available treatment options.

**Lifestyle interventions**

Women with all types of urinary incontinence can be advised to decrease their intake of fluids, caffeine, and carbonated drinks.<sup>44</sup> Women are taught, by both the media and the medical establishment, that it is necessary and optimal to drink eight glasses of water daily. Many women do not understand that the recommended six to eight glasses (240 mL each) of water a day includes the water present in food, which contributes substantially to overall total fluid intake.<sup>45</sup> Hence, re-education is appropriate for women with symptoms of overactive bladder syndrome who admit to excessive fluid intake, unless otherwise medically indicated.

Further behavioral modification includes timed voiding, with a goal of reducing voiding frequency to every two to three hours. Women who are unable to wait this long begin by voiding at a set interval (such as an hour) and then increase the time interval by 15-30 minutes each week until the desired interval is reached.<sup>46</sup> According to both AUA/SUFU and NICE guidelines, women with urgency or mixed urinary incontinence should be offered bladder training as a first line treatment.<sup>35 38</sup>

Constipation should be managed and avoided because this contributes to urinary incontinence and voiding dysfunction.<sup>47</sup> Women with a body mass index greater than 25 should be advised to lose weight if they present with new or worsening symptoms,<sup>34</sup> because weight loss significantly reduces symptoms of urinary incontinence.<sup>48</sup> A randomized trial of weight loss versus no intervention in 347 obese women with 10 or more episodes of urinary incontinence a week found a 65% reduction in stress urinary incontinence in the weight loss group versus 47% in controls at 12 months (P<0.001).<sup>48</sup>

**Pelvic floor muscle training**

Pelvic floor muscle training consists of strengthening the muscles of the pelvic floor (to reduce stress urinary incontinence) and contracting them in isolation to inhibit detrusor contractions (and reduce urgency urinary incontinence). More commonly known as Kegel exercises, these should be done several times a day and need to be performed consistently over time for benefit to be sustained. A systematic review of patients with urgency, stress, and mixed incontinence found that pelvic floor muscle training was more effective than placebo or no treatment at all and should be included as first line management for urinary incontinence.<sup>49</sup>

AUA/SUFU guidelines recommend pelvic floor muscle training as a first line treatment for overactive bladder syndrome.<sup>38</sup> NICE guidelines recommend offering a trial of pelvic floor muscle training for three months, with eight contractions being performed three times a day, as first line treatment for women with both stress and mixed urinary incontinence.<sup>35</sup> In a study of 22 women with pure stress incontinence, 32% were cured after three months.<sup>50</sup>

**FUTURE RESEARCH QUESTIONS**

What is the ideal treatment algorithm for patients in whom conservative management of overactive bladder syndrome has been unsuccessful? Should a patient be considered first for onabotulinumtoxinA, tibial nerve stimulation, or sacral nerve modulation? Which patients will best respond to which types of treatment?

What is the long term efficacy and safety of suburethral mini-slings and midurethral slings?

In the era of mesh related complications, are midurethral slings still safe?

What is the surgical outcome of repeat sling surgery after initial sling surgery has been ineffective?

When properly performed, these exercises may be more effective than pharmacologic management.<sup>51</sup> An RCT of 197 women with urgency urinary incontinence randomized to behavioral treatment, oxybutynin, or placebo found an 80.7% reduction of urinary incontinence episodes with behavioral treatment versus a 68.5% reduction with drug treatment and a 39.4% reduction with placebo (P=0.04).<sup>51</sup>

**Looking ahead**

As healthcare systems seek increased value at a lower cost, urinary incontinence is an area where costs can be considerably reduced through minimizing the use of diagnostic testing. Quality of care indicators are a means to measure the care provided to women with urinary incontinence and can be used as an algorithm for the investigation and treatment of urinary incontinence, regardless of provider specialty. This method is useful for areas in which the level of evidence is limited.<sup>34 93</sup>

The application of these algorithms can improve incontinence care at the generalist level and thereby reduce the need for specialty care, while algorithms applied to

specialist care can help reduce costly, and sometimes unnecessary, testing.

Further research is needed to improve our understanding of the physiology underlying overactive bladder syndrome. In addition, the prevention of lower urinary tract symptoms is an exciting area of research that has the potential to reduce the burden of urinary incontinence. Urinary biomarkers are an ongoing area of research, and several clinical trials are under way to identify the role of urinary nerve growth factor, prostaglandin E2, ATP, and others as potential biomarkers for overactive bladder syndrome to identify at risk patients and predict responsiveness to treatment (see [clinicaltrials.gov](http://clinicaltrials.gov)).

**Conclusion**

Urinary incontinence affects a large number of women and results in a substantial socioeconomic burden. Minimally invasive treatment measures can readily be initiated by primary care providers, with referral to a specialist when conservative management is not effective. Many minimally invasive and efficacious treatment options are available for both stress and urgency urinary incontinence. Despite the high rate of mesh related complications after vaginally placed mesh for prolapse, midurethral mesh slings for stress urinary incontinence have an acceptably low complication rate with durable efficacy. Newer treatments for overactive bladder syndrome and urgency urinary incontinence, including mirabegron and intravesical botulinum injection, have greatly changed the landscape of treatment, providing a wide range of treatment options to patients with overactive bladder syndrome that is refractory to traditional anticholinergic drugs.

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References are in the version on [thebmj.com](http://thebmj.com).

**ANSWERS TO ENDGAMES, p 36**

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**ANATOMY QUIZ**

**Anatomy of the brain: T2 weighted magnetic resonance image, axial section**

- A: Right thalamus
- B: Right internal capsule
- C: Right lentiform nucleus
- D: Left head of caudate nucleus
- E: Left fornix
- F: Paired internal cerebral veins

**PICTURE QUIZ**

**An abnormal chest radiograph**

- 1 There is marked deviation of the trachea to the right, with a homogeneous opacity in the upper mediastinum.
- 2 It shows a large mass in the anterior mediastinum that seems to arise from the thyroid.
- 3 Teratoma, lymphoma, goitre, and thymoma.
- 4 Thyroid function tests and flow volume loops. Referral to the cardiothoracic team.

**STATISTICAL QUESTION**

**Spearman's rank correlation coefficient**

Statement *a* is true, whereas *b* and *c* are false.