

Urinary incontinence in physically active women and female athletes

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ABSTRACT

A literature review was performed on the topic of urinary incontinence during physical activity and sports. This paper reviews the prevalence, risk factors, pathophysiology and treatment modalities of urinary incontinence in physically active women and female athletes. Urinary incontinence affects women of all ages, including top female athletes, but is often under-reported. The highest prevalence of urinary incontinence is reported in those participating in high impact sports. Pelvic floor muscle training is considered the first-line treatment, although more research is needed to determine optimal treatment protocols for exercising women and athletes. Trainers, coaches and other athletes' caregivers should be educated and made aware of the need for proper urogynaecological assessment.

INTRODUCTION

Urinary incontinence is the complaint of involuntary loss of urine.¹

Urinary incontinence is classified as stress incontinence, urgency incontinence, postural incontinence, nocturnal enuresis, mixed incontinence, continuous incontinence, insensible incontinence and coital incontinence. Stress urinary incontinence, the most common type, is the complaint of involuntary loss of urine on effort or physical exertion (eg, sporting activities) or on sneezing or coughing. Urgency incontinence is the complaint of involuntary loss of urine associated with urgency. Mixed incontinence describes the coexistence of both symptoms.¹

Urinary incontinence is a common problem affecting women of all ages. The prevalence of any leakage at least once a year is 25–45%,² and weekly urine leak is reported in as many as 10%.³ The prevalence of urinary incontinence increases with age, from 7% in non-pregnant women aged 20–39 years to 17% in ages 40–59, 23% in ages 60–79 and 32% in women over 80 years old.⁴ The prevalence of urinary incontinence during pregnancy is higher: 30–60%, and 6–35% during the postpartum period.⁵ Urinary incontinence is under-reported, with only 5–50% of cases being reported and addressed by caregivers of athletes as well as non-active women.^{6–10}

Risk factors for urinary incontinence in women are age, parity, obesity, diabetes, stroke, smoking, depression, other urinary symptoms, functional impairment, high-impact physical activities, oestrogen deficiency and genitourinary surgery (eg, hysterectomy), and the use of medications such as psychotropic medications, angiotensin converting enzyme (ACE) inhibitors and diuretics.^{11–14}

Urinary incontinence is associated with medical and psychological morbidity that greatly influences

the quality of life, and has a negative impact on athletic performance.¹⁰ Medically, it can be associated with perineal candida infections, cellulitis, pressure ulcers, urinary tract infections, sleep disturbances and even higher risk of falls and fractures.^{15–16} Psychological morbidity related to urinary incontinence includes low self-esteem, higher rates of depression, social withdrawal and sexual dysfunction.¹⁷

Less than one-half of incontinent individuals report the problem to their caregivers. Therefore, healthcare personnel must inquire about the possible existence of urinary incontinence.^{7–18} The patient's history includes the onset of incontinence, associated urinary symptoms, leakage frequency, volume and timing, precipitating factors, bowel function, sexual function, risk factors and the use of medications. Urgency symptoms are sensitive and specific for the diagnosis of urge incontinence; however, leakage with stress manoeuvres is sensitive but less specific.¹⁹ The physical examination should include examination of the abdomen, the cardiovascular system (ie, signs of volume overload) and the extremities (ie, joint mobility), and a neurological examination should be performed to rule-out neurological disease in patients with a new onset urinary incontinence. The genital examination should reveal or exclude evidence for atrophy, inflammation, a pelvic mass, pelvic floor weakness (cystocele, rectocele and enterocele), urethral hyper mobility, sphincter tone and pelvic floor muscle (PFM) function. Further investigation should be based on the patient's history and physical findings.²⁰

Urinary incontinence in active exercising women

Women with stress urinary incontinence may leak during physical activity and exercise; however, they can be continent during their daily activities.²¹ Consequently, this might lead the woman to become inactive, thereby refraining from exercise and recreational activities in order to avoid urine leakage.²¹ Inactive women of all ages are at a higher risk for cardiovascular morbidity, hypertensive disease, diabetes mellitus, obesity, cancer and osteoporosis.²² About 30% of exercising women experience urine leak during at least one type of exercise.²¹ High-impact physical activity, where both feet are off the ground at the same time (ie, jumping, running), involves abrupt repeated increase in intra-abdominal pressure. High-impact activity has been associated with higher rates of urinary incontinence in non-pregnant women, pregnant women and postpartum.^{8–23} Long-term, low-impact moderate exercise is inversely associated with urinary incontinence in young, middle-aged

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and older women.^{24–26} However, these findings may be due to the confounding that women with urinary incontinence withdraw from exercise.

Urinary incontinence in female athletes

Top female athletes report a high prevalence of urinary incontinence, especially during sport but also during daily activities. The prevalence of urinary incontinence ranges from 28% to 80%, with the highest prevalence in high-impact sportswomen such as trampolinists, gymnasts, aerobic gymnasts, hockey players and ballet dancers.^{7 8 27–30} Jumping is the activity that is most likely to provoke leakage. More athletes experience leakage during training rather than competition (95.2% vs 51.2%), possibly because of higher catecholamine levels during competition that act on the urethral α -receptors to maintain its closure.³⁰

Both stress incontinence and urgency urinary incontinence are prevalent among athletes. Urgency urinary incontinence is most apparent in cyclists and football (soccer) players.²⁹ Female elite trampolinists report the highest prevalence of urinary incontinence, 80%, with large amounts of urine leak per 15 min session measured by a pad test (urine leak collection): mean 28 g, range 9–56 g. The amount of leakage was not found to be correlated to the PFM strength measured by a perineometer.²⁷

PATHOPHYSIOLOGY

Several studies were aimed at determining the mechanisms involved in athletes' urinary incontinence. There are *two hypotheses* about how strenuous exercise might affect the pelvic floor: (1) physical activity may strengthen the PFMs and (2) physical activity may overload and weaken the pelvic floor.³¹ Athletes reported urine loss more frequently during the end of the training session and the second part of the competition, suggesting that pelvic floor muscular endurance is required.^{8 27} Ree *et al*³² found that there was short-term fatigue of the PFMs in women with stress urinary incontinence following 90 min of strenuous physical exercise.

Bø and Sundgot-Borgen³³ analysed data from athletes who were competing in the Norwegian national teams during the 1980s, and did not find a higher prevalence of urinary incontinence 15–17 years later, at age 30–50, compared with controls. Although being a former elite athlete was not associated with higher prevalence of urinary incontinence later in life, urinary incontinence in early life was a strong predictor of later urinary incontinence. High-impact Olympic athletes did not have a higher prevalence of urinary incontinence compared with low-impact Olympians who competed between 1960 and 1976, when assessed 20–30 years later.³⁴ However, these findings were based on performing athletes before 20–50 years, and it is possible that the more provocative gymnastic manoeuvres performed nowadays may damage the pelvic floor and increase the risk for later incontinence.

Eating disorders are associated with higher prevalence of both stress and urgency urinary incontinence. In a study of Norwegian elite athletes,³⁵ the prevalence of stress urinary incontinence (49.5%) and urgency urinary incontinence (20%) in eating disordered athletes was significantly higher than in healthy athletes (38.8% $p=0.003$ and 15% $p=0.048$). A significant correlation ($p=0.03$) between urinary incontinence, positive pad test and eating disorders was also reported in long-distance runners.³⁶ Eating disorders may weaken the pelvic floor due to lack of energy and the nutritional factors needed to build and strengthen the muscles, ligaments and fascia. Several eating disorders involve induced vomiting, which generates repetitive high pressure on the pelvic floor, with further possible weakening. Oestrogen deficiency states, as seen in anorexia

nervosa and in anorexia athletica, are risk factors for both stress and urgency urinary incontinence.³⁵ Therefore, eating-disordered athletes have a high risk for urinary incontinence, even if they participate in low-impact sports.

On the other hand, the hypothesis that high-impact activity may strengthen PFMs was verified by Kruger *et al*^{37 38} The cross-sectional areas and thickness of the levator ani and puborectalis were measured by magnetic resonance imaging (MRI), and were found to be increased in women who participated in long-term, high-impact sport and exercise.³⁷ The pubovesical muscle was demonstrated and measured by translabial two-dimensional and three-dimensional ultrasound; bladder neck descent and the area of the levator hiatus were also measured. High-impact athletes had increased muscle diameter, greater bladder neck descent and a larger hiatal area during the Valsalva manoeuvre, compared with non-athletes.³⁸ High-impact training results in thicker muscles that may compensate for the greater muscle distensibility. The differences observed may be because those able to continue high-impact sports already have stronger and thicker PFMs, or due to differences in connective tissue or muscle biomechanics that may be a consequence of high-impact training. Women with stress incontinence have less collagen concentration in their skin and periurethral tissue, and a decreased ratio of type I to type III collagen.^{39 40} Hypermobility syndrome, which is characterised by a decreased ratio of type I to type III collagen, is associated with an increased prevalence of pelvic organ prolapse, but not urinary incontinence.^{38 41} Moreover, high-impact varsity athletes with increased foot arch flexibility had less urinary incontinence, possibly because of the better shock-absorbing capacity of their lower extremities.²⁸

In conclusion, two opposing hypotheses exist on the effect of exercise on PFMs, with a possible mixed effect of both mechanisms on the athletes' urinary incontinence.³¹

TREATMENT

Treatment of urinary incontinence should start with treating contributing factors, such as eating disorders, genital atrophy, smoking, obesity and reduction of caffeine and alcohol consumption. Incontinent athletes should avoid excessive fluid consumption before training and competition; however, care should be given to avoid dehydration. They should be instructed to void shortly before training sessions and competitions.⁴²

Pelvic floor muscle training (PFMT) is an important component for both prevention and treatment of urinary incontinence, and it has no known side effects. It is an effective treatment for postpartum urinary incontinence, especially in primiparas.⁴³ PFMT should be the first line of treatment for women with stress, urgency and mixed incontinence, although women with stress incontinence benefit most.⁴⁴ Bø *et al*⁴⁵ found that it is a more effective treatment for stress incontinence in middle-aged parous women than no treatment, electrical stimulation or vaginal cones. In a Cochrane review of 17 studies, weighted vaginal cones were better than no active treatment in women with stress urinary incontinence, and may be of similar effectiveness to PFMT and electrical stimulation.⁴⁶ Biofeedback is a technique that uses monitoring instruments to measure and provide back the information about physiological activities and muscle tension. Specifically, measurements of the response from a single PFM contraction can be used during PFMT. Biofeedback is an adjunct to training. It is used to make patients more aware of muscle function, and to enhance and motivate patients' effort during training. No additional effect was proved by adding biofeedback to PFMT.⁴⁷ PFMT should emphasise precontraction for preventing urethral descent and leakage during exertion. The use of biofeedback techniques includes training in different

positions and PFM contraction while performing real physical activities. The goal is to provoke a quick, strong and well-defined PFM contraction before and during rise in intra-abdominal pressure, known as 'the Knack'.⁴⁸ Active sport students with urinary incontinence who were treated with PFMT achieved increased PFM strength, reduced frequency of incontinence episodes and a smaller amount of urine leak in each episode.⁴⁹ A combined pelvic floor rehabilitation programme including biofeedback, electrical stimulation, PFM exercises and vaginal cones was beneficial for treatment of urinary incontinence in three volleyball players.⁵⁰ However, this is an extremely small group of subjects to conclude effectiveness. To our knowledge, no randomised controlled trials have been published on the effect of any specific treatment for stress urinary incontinence in female elite athletes.

Common exercises taught in gymnastics, Pilates and yoga classes do not necessarily elevate the bladder neck, and they might even result in bladder neck descent. Coactivation of PFMs was not found during typical Pilates and yoga exercises in a study using transperineal ultrasound.⁵¹ A study that compared the results of traditional PFMT versus Pilates exercises demonstrated the improvement of PFM strength in both groups, with no differences between the groups.⁵² Urinary incontinence is prevalent among fitness instructors, including yoga and Pilates teachers, with prevalence rates similar to other subgroups of physically active women and athletes.⁵³ Yoga and Pilates classes are probably not an effective treatment by themselves, but could be an excellent opportunity for incorporating PFM exercises.

The Paula method of circular muscle training is based on Paula Garburg's assumption that all sphincters in the body work together and can affect one another. Accordingly, damaged muscles can be rehabilitated by contraction and relaxation of specific circular muscles in other areas of the body, such as the orbicularis oris around the mouth and the orbicularis oculi around the eyes.⁵⁴ The Paula method has been reported to be effective for stress urinary incontinence in two studies.^{55 56} However, these studies compared two different interventions concerning the number of sessions, length of sessions and length of treatment period. They demonstrated improvement by questionnaires and pad test, but failed to demonstrate significant changes in muscle floor strength measured by palpation and perineometry. In a study measuring PFM activity by surface electromyography during PFM contraction and during a Paula-method contraction,⁵⁷ the Paula method did not increase PFM activity. A comparison of the levator hiatus and PFM length by a four-dimensional ultrasound study⁵⁸ found a significant reduction of the levator hiatus area and muscle length during PFM contraction, but not during a Paula method contraction.

Medications, such as imipramine, can improve quality of life in incontinent women,²³ but have not been studied in athletes. Duloxetine, a serotonin and norepinephrine reuptake inhibitor, can significantly improve the quality of life in patients with stress urinary incontinence, but it is unclear whether or not it cures the symptoms. Duloxetine is commonly associated with nausea, which may cause non-compliance with this treatment.⁵⁹ A Cochrane review found only weak evidence that adrenergic agonists were better than placebo treatment for stress urinary incontinence. Side effects were rare and usually minor, but serious side effects, such as cardiac arrhythmias and hypertension, have been reported.⁶⁰ Pseudoephedrine hydrochloride, a common α -adrenergic drug, is prohibited during competition in doses exceeding urine concentration of 150 $\mu\text{g}/\text{ml}$.⁶¹ Anticholinergic drugs are a common treatment of urinary

incontinence. These medications are not recommended for use in athletes because they may compromise the sweating mechanism, and therefore increase the risk for heat stroke.⁴²

Surgery in women is indicated when the degree of incontinence is sufficiently troublesome to the patient, the incontinence has been observed by the examiner, its causes have been adequately evaluated and the conservative therapy failed.²³ Common surgical treatments include pubovaginal sling procedures, retropubic suspension and periurethral injections. Surgery is inappropriate in young women, including elite athletes, who are continent during regular daily activities and have incontinence only during exercise and sport.⁶²

CONCLUSION

Urinary incontinence is frequent and troublesome among exercising women and athletes, and is highly under-reported. High-impact sports and eating disorders increase the risk for urinary incontinence. Non-athletic women should be encouraged to participate in mild to moderate exercise activities that improve their general health and may even improve urinary incontinence. Urogynaecological assessment is advised in competitive athletes. PFMT should probably be incorporated into their fitness and training programmes. More research is needed to determine optimal PFMT protocols for athletes. Trainers, coaches and other athletes' caregivers should be educated and made aware of this frequent but under-reported complaint.

What are the new findings?

- ▶ Urinary incontinence is prevalent among female athletes and is highly under-reported.
- ▶ High-impact sports, such as trampoline jumping, are associated with the highest prevalence of urinary incontinence.
- ▶ Athletes with eating disorders have an increased risk of urinary incontinence, even if they participate in low-impact sports.

How might it impact on clinical practice in the near future?

- ▶ Pelvic floor muscle training should be the first-line treatment for urinary incontinence in women, and should probably be incorporated into athletes' training programmes.
- ▶ More research is needed to determine optimal treatment protocols for urinary incontinence in exercising women and athletes.
- ▶ There is a need to increase the awareness of athletes and their professional team to the complaint of urinary incontinence.

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