Urinary Incontinence and Sport: First and Preliminary Experience With a Combined Pelvic Floor Rehabilitation Program in Three Female Athletes

MASSIMO RIVALTA, MARIA CHIARA SIGHINOLFI, SALVATORE MICALI, and STEFANO DE STEFANI
Department of Urology, University of Modena, Modena, Italy

FRANCESCA TORCASIO
Department of Public Health Sciences, University of Modena, Modena, Italy

GIAMPAOLO BIANCHI
Department of Urology, University of Modena, Modena, Italy

A relationship between sport or fitness activities and urinary incontinence (UI) previously has been described in women. We report our preliminary experience with the use of a complete pelvic floor rehabilitation program in three female athletes affected by UI. The athletes were submitted to a combined pelvic floor rehabilitation program, including biofeedback, functional electrical stimulation, pelvic floor muscle exercises, and vaginal cones. After the scheduled rehabilitation scheme, none of the patients reported incontinence, nor referred to urine leakage during sport or during daily life. We therefore conclude that UI that affects female agonistic athletes may be effectively treated with this combined approach.

International medical literature has focused on the correlation among sports, fitness activities, and women’s pelvic floor dysfunction: an association with competition sports and UI was clearly evident (Bø, 2004; Carls, 2007; Greydanus & Patel, 2002; Warren & Shantha, 2000). This occurrence represents a barrier to women’s participation in sport and fitness activities, and results in a significant impairment in their quality of life (Carls, 2007). Until

Received 17 December 2008; accepted 9 September 2009.
Address correspondence to Dr. Massimo Rivalta, Department of Urology, University of Modena, Via del Pozzo, 71, Modena 41100, Italy. E-mail: ri.max@hotmail.it
now there have been no randomized controlled trials on the effect of any treatment for stress UI in female elite athletes (Bø, 2004): in this setting, we introduce the role of a complete pelvic floor rehabilitation program, as a noninvasive approach, in order to effectively treat this debilitating, chronic condition. Since UI may relate to sport activity, a proper surveillance (gynecologists, urologists, sports doctors, family physicians, trainers) is advised of the competitive athletes.

Pelvic floor dysfunction is a major health issue for women, with a lifetime risk of 11% of women undergoing a single operation for UI, pelvic organ prolapse, or both (Dooley, Kenton, & Cao, 2008). The prevalence of UI in older adults living in the community is estimated to be as high as 30%, and studies have shown that incontinence increases with age. Studies on the prevalence of incontinence show 18% to 46% of women 25 to 64 years old report UI symptoms, while up to 15% to 37% of women older than 60 years report incontinence symptoms (Dooley et al., 2008). Urinary incontinence (UI) is the eighth most prevalent chronic medical condition among women in the United States (Hu, Wagner, & Bentkover, 2004). In addition to the significant social impact that UI has on a woman’s quality of life, data have shown that this condition has a significant financial burden on individual and national health care dollars. Estimates of annual direct costs of UI in all ages in the United States were $10.3 billion in 1987 in reports by the National Institutes of Health, $16 billion in 1995, and $19.5 billion in 2000 (Hu et al., 2004). Thus, this condition has a significant emotional and financial impact that continues to have an upward trend. Urinary incontinence (UI) often is classified based on the inciting events that lead to the urinary leakage. While definitions vary in the literature, the International Continence Society defines three major subtypes of UI (Dooley et al., 2008): (1) stress UI is the complaint of involuntary leakage upon effort or exertion, or upon sneezing or coughing; (2) urge UI is the complaint of involuntary leakage accompanied by or immediately preceded by urgency; and (3) mixed UI is the complaint of involuntary leakage associated with the urgency and also with exertion, effort, sneezing, or coughing. Evidence suggests that UI and its subtypes differ across racial and ethnic groups (Dooley et al., 2008). A wide range of risk factors has been identified in several studies; they can be categorized into constitutional, obstetric, and gynecological risk factors. Aging and hysterectomy are well accepted and described as risk factors in most of the studies. Very few researchers, however, assessed exclusively young adult and middle-aged woman, where the reported prevalence is 26–58% (Peyrat, Haillot, & Bruyere, 2002).

The relationship between women’s UI and sport has been widely described in the most recent literature (Bø, 2004; Carls, 2007; Greylanus et al., 2002; Thyssen, Clevin, Olesen, & Lose, 2002; Warren et al., 2000). This occurrence represents a barrier to women’s participation in sport and fitness activities, and results in a significant impairment their quality of life.
Pelvic Floor Rehabilitation Program

(437) Actually, it was reported that up to 75% of the athletes may experience urine loss while participating in their sport (Nygaard, Thompson, & Svengalis, 1994). Of the sports studied, gymnasts and tennis players reported a higher incidence of urine loss. The cause for incontinence in athletes is thought to be multifactorial. Contributing factors include inadequate abdominal pressure transmission, pelvic floor muscle fatigue, and change in collagen or connective tissue. High-impact sports requiring jumping and landing may place participants at greater risk for incontinence because of the sudden increase in intra-abdominal pressure. Often this dysfunction goes under-reported or unreported. Health care providers need to be made aware of such problems so they may be better addressed. In addition to the risk factors identified earlier, the athlete who is amenorrheic or having irregular menstrual cycles may have low estrogen levels. This also can contribute to the development of incontinence. The importance of completing a directed detailed history cannot be overemphasized. Women may need to be asked if they experience incontinence. Health care providers should not leave it to women to report the problem.

Urinary incontinence (UI) is defined as the complaint of any involuntary leakage of urine and is a common problem in the female population, with prevalence rates varying between 10% and 55% in 15 to 64 year old women (Bø, 2004; Rovner, Wright, & Messer, 2008). The four major categories of treatment are behavioral, rehabilitative, pharmacological, and surgical. Pelvic floor rehabilitation (PFR) techniques represent the less invasive procedures, and should be considered as the first-line therapy because of the efficacy without side effects; furthermore, a surgical option is not compromised by this approach (Rovner et al., 2008).

A complete PFR may include the following steps: biofeedback (BFB), functional electrical stimulation (FES), pelvic floor muscle exercises (PFMEs), and PFME using vaginal cones (VCs). During the last decades, international medical literature has focused on the correlation among sports, fitness activities, and women’s pelvic floor dysfunction: an association with competition sports and UI was clearly evident (Bø, 2004; Carls, 2007; Greydanus et al., 2002; Warren et al., 2000).

We present a brief research report of preliminary findings with the use of combined PFR treatment techniques (BFB-FES-PFME-VC) in three young female athletes affected by UI.

MATERIALS AND METHODS

From January 2008 to June 2008, we evaluated three female nulliparous athletes (mean age: 30.6 years; range: 29–33) experiencing urine loss during sport and daily life. Mean body mass index was 21.4 (range 21–21.7), and
all of them were performing agonistic volleyball. Urinary incontinence (UI) was defined as the need for pad or panty liner during sport or daily life.

The patients fulfilled a 48-hour voiding diary and underwent urodynamic evaluation (Urobenchmark 200/3 SLEM., Milan, Italy) pointing out stress UI (mean abdominal leak point pressure: urinary leakage at 150 cm H2O abdominal pressure; mean maximum urethral closure pressure 70 cm H2O) without significant cystocele (grade 1 or less on Halfway system classification). Urine leakage during sport activity was reported in all the cases, especially during jumping. All the athletes needed to use a panty liner during training and competition; additionally, two of them use a preventive device such as vaginal tampons in order to prevent or decrease leakage during high-impact physical activity.

None of the patients presented with cardiac pacemaker, pregnancy, or urinary tract infection. Pelvic floor muscles were examined with urogynecologic evaluation and with a puborectalis test (PC test) to document pelvic floor muscle function and strength. The subjects experienced the combined PFR treatment regimen (BFB-FES-PFME-VC) after signing an informed consent with prior verbal explanation.

The steps for a complete PFR were as follows: (1) Functional electric stimulation (FES) was performed for 20 minutes once a week for a period of 3 months. Selected parameters included biphasic intermittent current with frequency set at 50 Hz, pulse width of 300 µs, and an adjustable current intensity (0–100 mA) reaching the most individually tolerable intensity of stimulation that does not cause pain (Paradiso Galatioto, Pace, & Vicentini, 2007). “On time” ranged from 0.5 to 10 seconds, and “off time” ranged from 0 to 30 seconds. (2) Biofeedback (BFB) was conducted for 15 minutes, once a week, for a period of 3 months. The special “Vaginal Combined Probe-Coloplast” (same size for all the patients) was used for vaginal stimulation and as a registering probe for both FES and EMG-BFB (Figure 1). It is made of a longitudinal small and soft cylinder with four radial electrodes along the probe itself. (3) Pelvic floor muscle exercises (PFMEs) were performed alone. (4) Pelvic floor muscle exercises (PFMEs) using VCs, were performed at home by the woman herself, after a preliminary stage with the urologist, accordingly to the Kegel protocol (Kegel, 1952); it requires at least 300 contractions a day of the PFM divided into six sessions, isolating PFM contractions and eliminating coactivation synergies, alternating isotonic and isometric exercises. Pelvic floor muscle exercises (PFMEs) were performed also using VCs: three plastic cones with a metal interior that are identical in shape and volume, but of different weights. The patient begins exercising with the heaviest cone retainable in the vagina for 1 minute; once the cone can be retained easily for 10 minutes, the patient starts exercising with the next heaviest cone. Before moving on to a heavier cone, it is worth checking that the cone can be retained during coughing, going up and down stairs, and running.
FIGURE 1 A vaginal probe was used for vaginal stimulation and biofeedback.

The followup was carried out at 4 months, with urogynecologic evaluation and a 48-hour voiding diary.

RESULTS

All the women completed the scheduled rehabilitation program, and their compliance was verified throughout a weekly visit. The same skilled physician, who reported a satisfying relationship with all the women, performed all the treatments. Patients reported pad or panty liner usage of 1–2 per day at baseline. After the combined rehabilitation program, none of them reported UI requiring device (pad or panty liner use), nor referred to urine leakage during sport and fitness activities or during daily life. No side effects or complications connected to the complete PFR were recorded.

The Pubococcygeus (PC)-test improved in all the athletes (Table 1).

DISCUSSION

The relationship between women’s UI and sport has been described widely in the most recent literature (Bø, 2004; Carls, 2007; Greydanus et al., 2002; Thyssen et al., 2002; Warren et al., 2000). Stress incontinence is the most frequent form affecting the athletes, and it can be defined as “involuntary leakage on effort or exertion, or on sneezing or coughing” (Bø, 2004). This occurrence represents a barrier to women’s participation in sport and fitness activities, and results in a significant impairment of their quality of life (Carls, 2007). To face this concern, several athletes are used to applying preventive
TABLE 1 The Pubococcygeus Test (PC-test) is Graded by the Modified Oxford Grading Scale (Laycock, 1992).

<table>
<thead>
<tr>
<th>Patient n°1</th>
<th>Pubococcygeus test (PC-test) at baseline</th>
<th>Pubococcygeus test (PC-test) after 4 month of rehabilitation program</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Patient n°2</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Patient n°3</td>
<td>2</td>
<td>5</td>
</tr>
</tbody>
</table>

Grade 0: no response.
Grade 1: flicker.
Grade 2: weak contraction.
Grade 3: moderate contraction, degree of lift.
Grade 4: good contraction, against some resistance.
Grade 5: normal muscle contraction, strong, squeeze and lift.

devices such as vaginal tampons (Glavind, 1997) or pessaries to prevent leakage during high-impact physical activity.

Actually, it was reported that up to 75% of the athletes may experience urine loss while participating in their sport (Nygaard et al., 1994). Gymnasts and basketball and tennis players are the most affected categories, with a reported incontinence rate of 67%, 66%, and 50%, respectively. These finding are consistent with those described in 2002 by Thyssen and colleagues, who described an incontinence rate of 51.9% in a young female population, mainly remarked upon as occurring during training but even in daily life activities. The need for pads or panty shields was evident in 60% of their series, especially when dealing with gymnastics, ballet, aerobics, badminton, and volleyball.

Nygaard and colleagues (1996) explored the relationship between UI in elite nulliparous athletes and force absorption on impact, as assessed by foot arch flexibility. They concluded that the way impact forces were absorbed may represent the potential aetiology for stress incontinence. The awareness of how impact forces are transmitted to the pelvic floor can provide important information about potential preventive interventions for UI and other pelvic floor disorders, such as genital prolapse.

The effect of the treatment for stress UI on female athletes has been mentioned only in international literature (Bø, 2004). Based on the experience that training of PFMs is effective in stress incontinent parous females in the whole population (Bø, 2004), we decided to manage those athletes with PFR. This approach has no serious adverse effects and has been recommended as a first-line treatment in the general population. A complete rehabilitation program may include different steps such as FES, BFB, PFMEs, and VCs, as previously suggested by Rovner and colleagues (2008).

The first step, BFB, derives from the combination of “biological” and “feedback” (biological back action or sensory backcontrol), which expresses the concept of a system capable of measuring physiological events that are
Biofeedback (BFB) acts in the early stage of rehabilitation programs, in order to facilitate conscious awareness of the pelvic area and to achieve an elective contraction of the pelvic floor muscles, particularly of the pubococcygeus (PC): it provides the direct perception of the contraction and quantification of its intensity via a visual or auditory signal. After its first description (Kegel, 1951), positive outcomes with BFB were recorded in 60–80% of the reported series (O’Donnell & Doyle, 1991; Susset, Galea, & Read, 1990).

In recent years, even functional electrical stimulation has gained popularity and its indication extended to urology, as a result of improved understanding of the pathogenesis and diagnosis of pelvic floor dysfunction. Its mechanism of action can depend on the indirect electrostimulation that depolarizes the peripheral somatic motor fibers of the pudendal nerve with a contraction of the urethral striated sphincter and the pelvic floor. Furthermore, depolarization of sensory fibers of the pudendal nerve leads to a reflex response, that is, contraction of the pelvic floor muscles, and inhibition of an overactive detrusor. Besides these so-called peripheral effects, there are also central effects that consist essentially of reorganization, coordination, and awareness of lower urinary tract and pelvic floor functions (Fall, 1984).

Furthermore, the use of PFMEs (with and without vaginal cones; Oláh, Bridges, & Denning, 1990; Versi & Mantle, 1989) plays an extremely important role in the conservative treatment of incontinence. A systematic review of randomized controlled trials revealed strong evidence about PFME effectiveness in reducing symptoms connected to stress incontinence and improving the quality of life (Berghmans, Hendriks, & Bo, 1998). Such a technique acts to advance the levator ani strength, as both a sphincter and a support for the pelvic viscera. Slow-twitch fibers are responsible for the maintenance of tone of the pelvic floor, thereby providing support to the pelvic viscera; the fast-twitch fibers mainly are activated during elevations of intra-abdominal pressure, such as coughing and sneezing. Kegel (1951), gynecologist and pioneer of modern PFME, considered that the abnormal function of the pelvic musculature (that he found in 30%–40% of women), could be caused in the first place by a lack of awareness of the perineum, followed by a deficit in neuromuscular coordination. In this way, a therapist’s task is to facilitate learning or relearning of pelvic floor activity and sphincter automatisms and not simple muscle strengthening in isolation (Di Benedetto, 2004).

To our knowledge, there are no randomized controlled trials on the effect of any treatment for stress UI in female elite athletes (Bø, 2004): in this setting, we introduce the role of a complete pelvic floor rehabilitation program as a noninvasive approach to strengthen muscular support. Unless
the small number of patients enrolled, our data are remarkable and may encourage further series to confirm these findings.

CONCLUSION

Since UI may relate to sport activity, a proper urogynecological surveillance is advised in competitive athletes. Improved abdominal pressures together with lack of levator ani support represent the basis of visceral descensus and decreased abdominoperineal reaction, impairing, as a consequence, urinary continence.

PERSPECTIVE

Even if pelvic floor rehabilitation is recognized as a proven and effective treatment for UI, the benefit of a complete rehabilitation program including biofeedback, functional electrical stimulation, pelvic floor muscle exercises, and vaginal cones, have been merely described. Stress UI, which affects a great part of the female agonistic athletes, may be effectively treated with this combined approach.

Trainers and physicians should consider this occurrence, and preventive strategies on female athletes are required.

REFERENCES


