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# Advancements in the Treatment of Urinary Stress Incontinence : Current Strategies and Future Directions

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**Abstract**

**Introduction and purpose**

Stress urinary incontinence remains a prevalent issue affecting both women and men, significantly impacting their quality of life and social participation. Stress urinary incontinence (SUI) is defined as the sudden, involuntary loss of urine secondary to increased intraabdominal pressure, which has a negative impact on the patient’s quality of life. SUI may be precipitated by a number of activities, including coughing, laughing, sneezing, straining, or exercising. Modern diagnostic and therapeutic approaches have improved outcomes for those affected, yet challenges persist, including accurate diagnosis and understanding of the underlying pathophysiology, as well as the development of effective treatment algorithms. The aim of the article was to present current guidelines for treatment of stress urinary incontinence depending on the individual patient's requirements.

## Material and methods

Review and summary of research studies available in open source format on Google Scholar and PubMed. The literature was reviewed using the keywords.

**Keywords:** stress urinary incontinence (SUI); pelvic floor muscle training (PFMT); Pessary; Burch colposuspension; Artificial urinary sphincter (AUS);

## Introduction and epidemiology

Urinary incontinence is defined as a condition characterised by the involuntary loss of urine, which can be perceived as a social problem and a source of concern regarding personal hygiene. It can be objectively diagnosed and treated. [6] SUI is a condition that manifests as urine loss during physical activity and can be classified into three distinct categories based on the severity of the symptoms: The first grade is characterised by urine loss when sneezing, coughing, and laughing. The second grade is defined by urine loss when getting up, when walking, or under physical activity. The third grade is idenitifed by urine loss while lying. [6] The prevalence of stress incontinence (defined as the occurrence of symptoms in the previous year) among adult women is approximately 46%. The frequency of the condition increases with age, reaching a maximum prevalence of 50% among women aged 40 years and older [1], and the proportion of the population with this characteristic is higher among white females than among black females.[1,2] This prevalence varies considerably according to the period evaluated (e.g. symptoms at any time in the past or within the last 1, 3 or 12 months), the intensity of the symptoms and the population studied (e.g. women living in communities or athletes [3]). Other risk factors include pregnancy and vaginal delivery, the risk of which is 2 times higher than that associated with a caesarean delivery [4] and additionally, there was observed in females with greater body-mass index (BMI). [1] A large-scale prospective cohort study of women with incident stress incontinence revealed that 70% of the women continued to experience symptoms of stress incontinence four years after the onset, while 60% reported symptoms eight years after onset. [5] Conversely, the prevalence of stress urinary incontinence (SUI) in males is associated with surgical treatment. It has been reported that the incidence of SUI following radical prostatectomy ranges from 2.5% to 90%. [7] The initial treatment for postoperative stress urinary incontinence is physiotherapy, which focuses on training the pelvic floor muscles and sphincter. In the event that conservative treatment proves ineffective, surgical intervention is indicated. [8]

## Non-surgical treatment of Stress Urinary Incontinence

### Pelvic floor muscle training

The evidence indicates that pelvic floor muscle training (Kegel exercises) can reduce the number of leakage episodes and the quantity of leakage. [9,10] A Cochrane review revealed that 74% of women who underwent pelvic-floor muscle training for a period of three to six months reported a cure or improvement, in comparison to 11% of women who received either no treatment or an inactive control treatment. [9]

Despite the absence of a consensus regarding the optimal training program, a regimen in which at least eight contractions are performed three times a day is recommended. [11] Nevertheless, the most up-to-date reviews on post-prostatectomy incontinence in men have not yet reached a definitive conclusion. [12]

**Pessary**

A pessary is a prostatic urethral device that is fitted into the vagina for therapeutic purposes. It is used to fight both pelvic organ prolapse and stress urinary incontinence. In the treatment of pelvic organ prolapse, the pessary has demonstrated comparable efficacy to pelvic floor muscle training in a randomised controlled trial.[13] Both treatments demonstrated improvement, with surgery exhibiting a significantly greater efficacy in a recent prospective cohort trial on pelvic organ prolapse. [14] Comparing the treatment pathway of pessaries and surgery with surgery alone, pessaries dominated surgery in the POP group, and pessaries had an additional cost-effectiveness ratio in the SUI population. [16] A pessary may additionally be utilised in the de novo context, in the absence of a prolapse, to treat SUI in urethral hypermobility cases. [15] The device is designed to elevate the urethra, thereby increasing the length of the urethra through a mechanism analogous to that employed in colposuspension or slings.

**Electrical Stimulation of the Pelvic Floor and Biofeedback**

Electrotherapy and biofeedback are both commonly used in daily clinical practice to exhaust non-interventional methods. In comparison to pelvic floor exercises for females only, the evidence is much more critical. Meta-analysis showed an advantage for electrotherapy compared with no treatment or SHAM treatment. [17] However, a large-scale and randomised trial of pelvic floor training versus pelvic floor training with biofeedback found no difference in results between these groups. [18]

**Other methods**

The evidence indicates that acupuncture may be an effective treatment for stress incontinence in the short term. [19] In a 18-session randomised trial, the application of electroacupuncture was found to substantially reduce urinary incontinence, as evidenced by a pad test conducted at six weeks. This outcome was observed in comparison to the use of sham acupuncture. [20]

**Pharmacological treatment**

Duloxetine, a selective serotonin/norepinephrine reuptake inhibitor (SSRI) commonly used to manage anxiety and depression, is available for the management of stress incontinence in Europe, but not in the United States due to a potential association with an increased suicidal risk. In randomised trials, duloxetine has been demonstrated to decrease stress incontinence in comparison with placebo, but the effects are relatively small and side-effects can be reported (e.g. in nausea [in 23% of females], mouth dryness [in about 13%], dizziness [11%] and obstipation [about 11%]). [21] National Institute for Health and Care Excellence guidelines suggest that duloxetine may be offered only if behaviour therapy has failed and if a woman

prefers pharmacological rather than surgical treatment or is a low surgical risk candidate. [11] Despite the efficacy demonstrated in patients with post-prostatectomy incontinence, duloxetine has not yet been approved for the treatment of SUI in men. [22]

**Surgical treatment of Stress Urinary Incontinence**

Surgery is considered the most effective prolonged treatment for stress incontinence, however, before any decision is made, it is critical for a patient-centered discussion to weigh up the risks and benefits of surgical intervention. The evidence indicates that the Burch colposuspension, midurethral mesh sling, urethral bulking and pubovaginal sling are beneficial in the treatment of stress incontinence. [23] Recently also implantation of artificial urinary sphincter has been used as promising therapy to cure SUI.

**Burch Colposuspension**

The Burch colposuspension, also called urethropexy, is one of the most frequently performed surgical methods. It involves the use of non-resorbable sutures that are placed in a manner that lifts the patient's lateral vaginal ligament to the level of the upper pubic bone fascia, creating a hammock-like effect. A 12-study meta-analysis of randomized trials demonstrated that the Burch colposuspension exhibited inferior efficacy compared to the midurethral sling. The overall cure rate was 74% for the Burch colposuspension, as opposed to 82% for the midurethral sling. [24] Other studies have idenfied that there were no differences in terms of efficacy, patient satisfaction or complications. However, patients who had undergone colposuspension had an increased prolapse risk. [25]

**Midurethral Mesh Sliding**

There are three major mesh sling types: the retropubic midurethral sling, which enters the retropubic space and exits through two suprapubic incisions; the transobturator midurethral sling, which enters the obturator foramen and exits through two groin incisions; and the one-incision midurethral sling or "mini sling", which consists of shorter pieces of mesh and requires only one vaginal incision. Both the transobturator and retropubic midurethral sling procedures have been demonstrated to be highly effective, with comparable short-term success rates. Both the transobturator and retropubic midurethral slings have been demonstrated to be highly effective, with comparable short-term subjective rates of cure. [26]
The use of mini-slings is associated with a reduction in postoperative pain, due to the fact that only a single vaginal incision is required. [27] The complication rates associated with mini-slings are comparable to those observed with retropubic and transobturator slings. However, the efficacy of mini-slings is less pronounced. [27, 28] The use of tape-based incontinence treatment is considered a reasonable and appropriate alternative, provided that patients are properly informed of the procedure and its potential risks. [29] Minimally invasive slings are available in 2 forms: adjustable and non-adjustable. They are suitable for patients with mild to moderate post-prostatectomy incontinence, a sufficiently mobile urethra, and a morphologically intact sphincter. [36]

**Artificial Urinary Sphincter (AUS)**

The artificial urinary sphincter (AUS) has been the established gold standard for the treatment of stress urinary incontinence (SUI) in men. Furthermore, the AUS is currently considered a viable salvage treatment option for SUI in women. Implantation of the AUS is performed on the bladder neck via a completely retropubic approach, with the pump inserted into one of the labia majora. [30] A small-scale study demonstrated a high success rate of more than 84% in patients who were followed up for a period of 18 months. [31]

**Bulking agents**

Urethral bulking represents the least invasive procedure among those available for surgical treatment. The procedure involves the injection of bulking material into the submucosa of urethra through a cystoscope, with the purpose of increasing urethral resistance. Urethral bulking is less effective than the procedures previously described. The 1-year cure rate is only 26% in a systematic review of 21 studies, and repeat injections may be necessary. [32] Nevertheless, it may be beneficial for women with a high operative risk, as it can be conducted in an examination room and adverse complications are uncommon, with an incidence of approximately 0.4%. [32, 33] Injections of bulking agents were frequently employed in men following post-prostatectomy incontinence.[34] While the procedure is notable for its low invasiveness, the long-term success rates appear to be relatively low. Furthermore, injections in the vicinity of the sphincter may have adverse effects on urethral mobility. [30]

**Stem Cell Therapy**

The precursor cells are idenitifed and isolated from living human tissue biopsies. Following this, they are multiplied in vitro. Subsequently, the explanted cells are combined with or planted on biodegradable polymers and replanted to repair or replace injured or diseased tissue. The overarching objective is the integration of the bioengineered cells into the surrounding tissue with the aim of rebuilding a functional organ. [36] The isolation of adult stem cells is primarily achieved through the extraction of cells from one of three sources: adipose tissue, bone marrow, or skeletal muscle. The advent of cell-based therapies has opened up a range of potential avenues for the development of alternative treatments for patients with urinary incontinence (UI) who have suffered damage to their sphincter function. [37] A significant number of research studies have investigated the preclinical and clinical applications of stem cells isolated from various sources, with encouraging outcomes for the treatment of SUI. [38, 39, 40] A series of promising feasibility studies with small cohorts has been conducted, indicating that cell therapies may become a viable option in the future. [41,42]

## Conclusions

Therapeutic options for urinary incontinence in both men and women can potentially enhance continence and thereby improve the quality of life. In many cases, this may be achieved through the use of implants, which, however, are associated with surgically significant risks, both peri and postoperatively. The underlying pathophysiology of incontinence in individual patients remains often undetermined. In conclusion, the future of this field will be shaped by two main factors: the advanced development of diagnostic techniques and the adoption of a more targeted approach to therapy. The literature review identifies the existing challenges in the management of stress urinary incontinence, while acknowledging the current of invasive and noninvasive methods.

## Disclosure

### Author's contribution

Conceptualization: Rafał Makuch and Adam Kucharski; Methodology: Alicja Wawrzyniak; Software: Alicja Chrościcka; Check: Andrzej Czajka and Kamil Gała; Formal analysis: Konrad Pilarski and Martyna Dewicka; Investigation: Paweł Lenard and Sara Michalska; Resources: Kamil Gała; Data curation: Alicja Chrościcka; Writing - rough preparation: Adam Kucharski and Rafał Makuch; Writing - review and editing: Alicja Wawrzyniak and Konrad Pilarski; Visualization: Martyna Dewicka; Supervision: Sara Michalska; Project administration: Rafał Makuch and Paweł Lenard; Receiving funding - no specific funding.
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### Conflict of interest

The authors deny any conflict of interest.

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