Functional Magnetic Stimulation of the Pelvis and Urinary Incontinence after Radical Prostatectomy

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Abstract:

Functional magnetic stimulation (FMS) is a method based on the use of a magnetic field to stimulate different parts of the body with the aim of their treatment or rehabilitation. As a noninvasive, relatively cheap and fast method without significant side effects, it is used for several decades for many parts of human body to reduce related pain or increase its functionality. In urology it is mainly indicated for pelvic floor rehabilitation to reduce problems with urination mostly in female patients, alone or more often in combination with different methods for pelvic floor rehabilitation. In this review we will present current role of FMS in patients with urinary incontinence after radical prostatectomy.

Keywords: functional magnetic stimulation, urinary incontinence, radical prostatectomy

Sažetak:

Funkcionalna magnetska stimulacija zdjelice i urinarna inkontinencija nakon radikalne prostatektomije

Funkcionalna magnetna stimulacija (FMS) je metoda koja koristi magnetno polje kako bi stimulirala različite dijelove tijela s ciljem njihova liječenja ili rehabilitacije. FMS je neinvazivna, relativno jeftina i brza metoda bez značajnih nuspojava koja se koristi više desetljeća za smanjenje bolova u različitim dijelovima tijela te povećanju njegove funkcionalnosti. U urologiji se koristi kod rehabilitacije zdjeličnog dna s ciljem smanjenja tegoba mokrenja većinom kod žena, sama ili češće u kombinaciji s drugim metodama rehabilitacije zdjeličnog dna. U ovom radu prikazati ćemo trenutnu ulogu FMS kod bolesnika s urinarnom inkontinencijom nakon radikalne prostatektomije.

Ključne riječi: funkcionalna magnetna stimulacija, urinarna inkontinencija, radikalna prostatektomija

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Introduction

Radical prostatectomy (RP) is considered the gold standard for the treatment of localized prostate cancer (PCa) in patients who are in good general condition and have a longer life expectancy. (1) However, this operation carries a significant risk of unwanted postoperative side effects such as erectile dysfunction (ED) and urinary incontinence (UI), which can be present in different extents (from very mild to very pronounced) and duration (from several weeks or months, up to several years and even more) in a significant number of patients. In the last two decades there has been an important progress in the diagnostic and surgical treatment of PCa, primarily towards earlier detection of the disease, but also increasingly widespread use of minimally invasive treatment modalities, all of which should reduce the frequency and intensity of these side effects, but they are still present in a relatively big number of patients. ED and IU carry a significant negative impact on the patient's quality of life and his satisfaction with the operation and present the burden to the healthcare system in general. Therefore, the emphasis is on methods that would prevent or reduce the probability of their occurrence, but also their severity and duration if they do occur.

Functional magnetic stimulation (FMS) is in use for several decades to treat many diseases, that is, to alleviate their symptoms and complaints. In urology, it is mostly used in the treatment of female incontinence by stimulating pelvic floor muscles but also having positive effect on bladder in general. (2)

The pelvic floor is a complex structure made of muscles and connective tissues, which plays a crucial role in maintaining urinary and bowel continence and normal sexual function by enabling a proper support of pelvic organs which, if insufficient, can present with different problems. Mechanism of FMS involves the application of magnetic fields to specific areas of the body to induce electrical currents within the targeted tissues. The principle behind FMS lies in Faraday's law of electromagnetic induction, where a changing magnetic field induces an electric field. (2,3) In the case of pelvic floor stimulation, FMS devices generate magnetic pulses that penetrate the pelvic region, stimulating the nerves and muscles responsible for pelvic floor function. (4,5) By stimulating the pelvic floor muscles, FMS aims to enhance muscle strength, improve coordination, and promote neuromuscular reeducation. Studies have proven benefits of using FMS for pelvic floor disorders such as stress urinary incontinence, overactive bladder, and pelvic pain syndromes. (6) Furthermore, the role of FMS in sexual dysfunction, including ED and female sexual arousal has been explored as a potential therapeutic modality to improve sexual function by enhancing pelvic floor muscle tone and increasing blood flow to the genital area with promising initial results which demand further investigation/confirmation. (7) FMS is most often performed as an outpatient procedure, where patients come for a certain number of cycles (several times a week for several weeks), according to pre-planned protocols with certain magnetic field strengths and duration of stimulation, often predefined by the FMS device manufacturers. The method is well tolerated with minimal side effects, which also ranks it among the first methods used in urinary incontinence, especially for patients who prefer non-invasive approaches. Furthermore, FMS can be used in combination with different behavioral therapy for management of incontinence, from lifestyle changes (maintaining healthy bladder habits, moderate liquid and beverage intake, monitor diet and medications, maintain bowel regularity and healthy weight as well as stop smoking) to bladder training and urgency reduction strategies, pelvic floor muscle training (without or with biofeedback), different drugs and stimulators, further improving it applicability. (8)

Urinary continence after RP

There are at least several reasons why urinary continence can be damaged after RP. Bladder, bladder neck and urethra with the prostate, as well as surrounding and belonging musculoskeletal and nervous structures and tissue form a unique functional unit that enables filling and controlled emptying of the bladder. It is known that with the years of life, i.e. aging, due to various reasons, this function is less or more impaired, therefore many of patients are "entering" surgery with already changed urinary function. (9) A large number of them have other diseases from cardiovascular and neurological to metabolic, moreover many of them have combination of these conditions, further increasing the likelihood of UI, i.e. problems with urination, after RP. When preoperative urinary function was assessed to evaluate baseline urinary status of patients, studies reported that from 10% up to almost 50% of participants have reported different forms of urinary disfunction from urinary leakage (incontinence) to obstructive urinary symptoms with different expression (from mild to severe) levels. (10-13)

Beside general factors, there are also local factors which can influence postprostatectomy continence, and among them urethral length, neurovascular bundle (NVB) status and surgical techniques are considered to be the most important one. Previous studies have shown that urethral status is an important factor for postprostatectomy UI. In order to properly assess it, different methods can be used from magnetic resonance imaging to obtain anatomical data and urodynamic studies to add functional information's regarding pressure values before and/or after the surgery.(14,15) However, these methods can add additional costs, time and burden for the patients and therefore are not used often. With the introduction of minimally invasive procedures, we have new methods which can be used to assess preserved part of the urethra by using semi-quantitatively measured on a video screen which have confirmed that patients with longer preserved urethral length have a significantly higher rate of post-operative urinary continence recovery. (16) This noninvasive approach

can be interesting for application since it can be easily done, although additional validation is needed.

NVB is a delicate structure that is located on peripheral sides of the prostate. It was initially described by the P.C. Walsh and P. Donker with pioneering work performed by dissection on a stillborn male infant to map the nerves to the bladder. In April 26, 1982, Walsh performed the first intentional nerve-sparing radical prostatectomy on a 52-year-old professor of management. It took several months for the patient to make a full recovery, but he has remained fully functional and cancer-free ever since. (17) Since this initial description, numerous papers have been published about NVB and its role in preservation of erectile and urinary function, and although its role in preserving erection is proven, conclusions regarding its role in urinary continence are not so straight forward. There are several issues that need to be resolved before a final conclusion is reached, which may also not be universally applicable to all patients. For example, how important are nerves passing through NVB for continence itself? If we preserve them, will our patients for sure be continent and when? Shortly after surgery, i.e. catheter removal, or several days, week or months after surgery? Is anatomical preservation also functional? Is NVB preservation just a marker of less invasive procedure and thus less damage to the urethral/periurethral tissue, which is then actually the real cause of better continence after nerve sparing RP? It is not easy to answers these questions, and in search of an answer in the published literature, we should also critically analyze the studies since they can differ significantly in their design including the number of patients and their characteristics (age, body mass index, comorbidities, etc.), procedures performed (open, laparoscopic or robotic RP), scoring of postoperative continence and potence as well as patient follow up, but in general we can say that there has been shown that preservation of NVB has a positive effect on postprostatectomy continence at least for early postoperative period.(13)

Surgical experience and the technique is something that has also been shown to be very important for preservation of urinary continence and erectile function but also for achieving cancer free status. After all it is logical that with more experience, we can perform better surgery. Numerous papers have been published about surgical technique, furthermore, afore mentioned preservation of urethral length and NVB sparing technique are also parts of the surgical approach. These methods as bladder neck sparing technique, Retzius sparing technique, dorsal venous complex resection/ligation, posterior reconstruction (Rocco Stitch), anterior

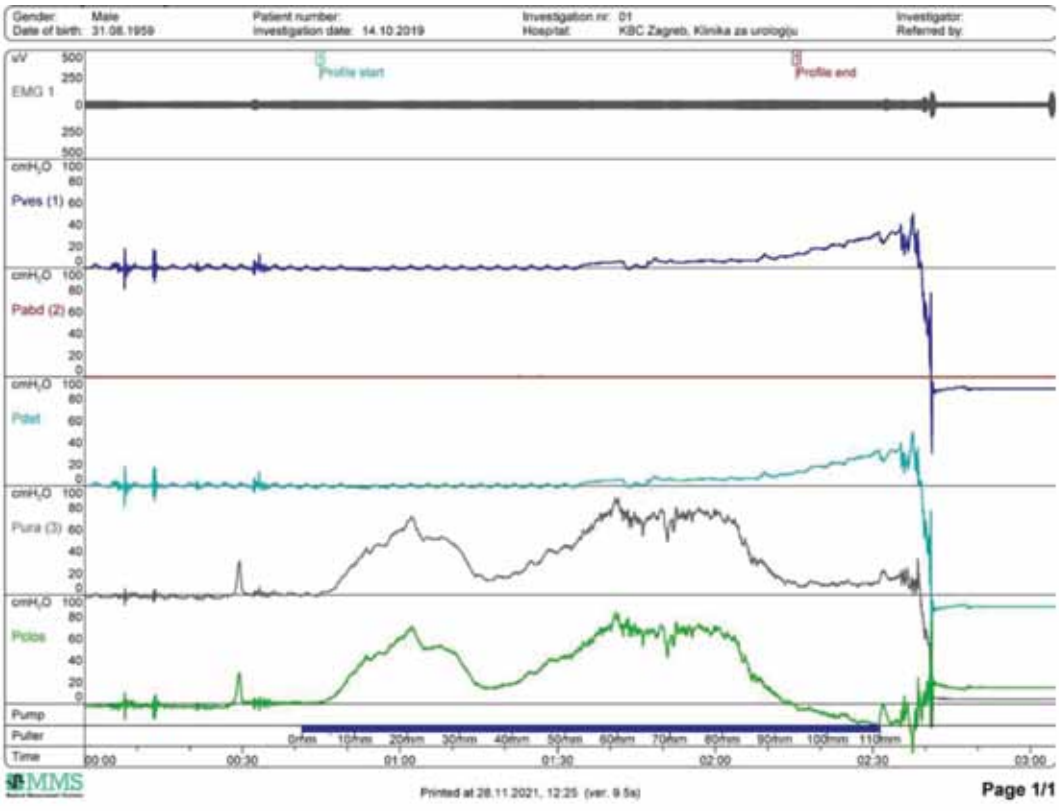

Figure 1. Image of profilometric measurement of the functional urethra before RP.

retropubic suspension (Patel Stitch), total anatomical reconstruction, placement of suprapubic tube, just to mention most common, have introduced smaller or bigger changes in surgical procedures, to increase continence rates.(18) If we have so many procedures and modification used by different surgeons than we do not have a standard procedure and it is logical that our results can be different. A number of factors influence the type of surgery, and the steps involved, from our education and personal preferences to patient characteristics and technical capabilities and will likely always differ or be somewhat different for different surgeons. Therefore, it is even more important to have a standard procedure which can be used after surgery or even before to improve urinary continence after RP.

The number of studies that investigated the role of FMS in patients after PR is not large and mostly involved a relatively small number of patients, so their results are limited, although in principle a positive effect of FMS has been proven.(19,20) The improvement itself was manifested by shortening the time to achieve urinary continence, after FMS, i.e. by reducing the number of pads used, but also by increased patient satisfaction after therapy. (21-24)

In order to obtain additional information about the role of FMS after RP, we are conducting a clinical trial using the electromagnetic generator of the Tesla Care device (IskraMedical d.o.o. Ljubljana Slovenia) which has already been used in our institution since 2018, mainly for female stress incontinence. Patients will be randomized in two groups, those treated with FMS from the electromagnetic generator under the seat and the group without contact between the electromagnetic generator and the pelvis (sham treatment). Patients will have two weekly treatments as an outpatient procedure for 4 weeks for a total of 8 treatments according to a predefined protocol by the manufacturer with additional modifications if needed (Figure 2). For urinary continence assessment we will use the International Consultation on Incontinence Questionnaire (ICIQ-UI SF) questionnaire as well as findings about the number of pads used/day, both procedures have been validated and are widely used as simple, fast and objective methods for the assessment of urinary function. For statistical analysis we will use the program STATISTICA 6.1 StatSort Inc., Tulsa, OK, USA. The patients will be followed for at least one year after RP. This trial will provide additional information about on the role of FMS in patients after RP that can be used to further improve our knowledge of the role of FMS in urinary incontinence.

Figure 2. FMS of the pelvic floor after RP (patient position and stimulator settings).

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