

Management of Bladder and Bowel Dysfunction in Patients with Multiple Sclerosis

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ABSTRACT

Bladder and bowel dysfunctions are common in patients with multiple sclerosis (MS) and negatively affect their quality of life. Bladder dysfunction, which is prevalent in people with MS (PwMS), can impact almost all patients within 10 years after diagnosis. Conservative, medical, and electrical stimulation approaches are used in the treatment of these problems. Bladder dysfunction in patients with multiple sclerosis can lead to issues such as fluid intake restriction, withdrawal from work life, inability to socialize, and the need for constant use of pads, resulting in a depressive lifestyle. Bowel dysfunction in patients with multiple sclerosis can manifest as fecal incontinence and/or constipation, which can also negatively affect patients' quality of life. Various approaches are utilized in the management of bladder and bowel dysfunction. Multiple sclerosis nurses play a key role in the multidisciplinary team for the diagnosis, treatment, and follow-up of patients' bladder and bowel symptoms. Effective nursing care, education, and counseling in the management of these symptoms enhance the comfort of patients with multiple sclerosis. In this review, the bladder and bowel dysfunctions experienced by patients with multiple sclerosis and the management of these problems are discussed in line with current knowledge.

Keywords: Bladder; bowel; dysfunction; multiple sclerosis; nursing.

Multipl Sklerozlu Hastalarda Mesane ve Bağırsak Disfonksiyonunun Yönetimi

ÖZ

Multipl sklerozlu hastalarda mesane ve bağırsak disfonksiyonları sık görülür ve yaşam kalitelerini olumsuz etkiler. Multiple skleroz hastalarında sık görülen ve yaşam kalitelerini etkileyen mesane disfonksiyonu, tanı konulduktan 10 yıl sonra hemen hemen tüm hastaları etkileyebilmektedir. Bu sorunların tedavisinde konservatif, medikal, elektriksel uyarı gibi yaklaşımlar kullanılmaktadır. Multipl sklerozlu hastalarda mesane disfonksiyonu sıvı alımının kısıtlanması, iş hayatından çekilme, sosyalleşememe ve sürekli ped kullanma ihtiyacı gibi sorunlara yol açarak depresif bir yaşantıya neden olabilir. Multipl sklerozlu hastalarda bağırsak disfonksiyonu fekal inkontinans ve/veya konstipasyon şeklinde görülebilmekte ve hastaların yaşam kalitelerini olumsuz yönde etkileyebilmektedir. Mesane ve bağırsak disfonksiyonu yönetiminde çeşitli yaklaşımlar kullanılmaktadır. Multipl skleroz hemşireleri hastaların mesane ve bağırsak semptomlarının tanı, tedavi ve takibinde multidisipliner ekipte anahtar role sahiptir. Bu semptomların yönetiminde etkili hemşirelik bakımı, eğitim ve danışmanlık verilmesi multipl sklerozlu hastaların yaşam kalitelerini arttırmaktadır. Bu derlemede multipl sklerozlu hastaların yaşadığı mesane ve bağırsak disfonksiyonları ve bu problemlerin yönetimi güncel bilgiler doğrultusunda tartışılmıştır.

Anahtar Kelimeler: Mesane; bağırsak; disfonksiyon; multiple skleroz; hemşirelik.

INTRODUCTION

Multiple Sclerosis (MS) is an autoimmune, chronic neuroinflammatory, demyelinating disease of the central nervous system that is frequently observed in young ages and women (1). It is reported that the prevalence of MS in 2020 reached 2.8 million worldwide. The prevalence of MS varies according to genetic and geographical characteristics.

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According to the World MS Atlas, the prevalence of MS in Turkey is reported to be in the range of 20-60/100.000 (2).

Plaques that occur in MS can cause various symptoms (motor, sensory, cognitive, etc.). Bladder and bowel dysfunction is one of the most important problems that are frequently seen due to MS and negatively affect the comfort of patients (3). In this review, bladder and bowel dysfunction frequently encountered by patients with MS and their management and nursing care are discussed.

Bladder Dysfunction in Multiple Sclerosis

Bladder dysfunction, which is common in MS (PwMS) patients and affects their quality of life, can affect almost all patients 10 years after diagnosis (4).

Structures known as urination centers connected to the central nervous system are periaqueductal gray matter, pontine urinary center, medial frontal cortex, sacral voiding center, and hypothalamus. Disruption of the pontine and sacral urinary centers due to spinal cord pathology may cause bladder dysfunction (5). Bladder dysfunction seen in MS may occur as storage (37-99%), emptying (34-79%), and sometimes both storage and voiding problems (6). Overactive bladder syndrome (AAMS), one of the storage problems has been defined as a syndrome characterized by frequent urination and nocturia accompanied by a feeling of urgency, according to the definition of the International Continence Society (7). It is known that the severity of these symptoms in PwMS is also related to the physical ability of the patients. Emptying problems appear as detrusor external sphincter dyssynergia, which may result in decreased detrusor activity due to increased bladder outlet resistance, impaired detrusor contractility, and/or limited contraction time. This may cause issues such as urinary retention, intermittent urination, and an inability to feel relief in the bladder after urinating (8).

Management of Bladder Dysfunction and Nursing Care

Bladder dysfunction in PwMS can cause a depressive experience for many patients, such as restriction of fluid intake, withdrawal from work life, inability to socialize, and the need to use a continuous pad (9). Management of bladder dysfunction, which is closely related to quality of life, should be addressed systematically and comprehensively. When evaluating people with multiple sclerosis (PwMS) in terms of bladder problems, the existing issues should be defined first. The use of disease-specific screening forms by nurses while evaluating bladder problems will contribute to understanding the severity of the patient's condition and identifying and directing patients who need further evaluation. One such form, the "Bladder Symptom Screening Form," has been adapted into Turkish by an MS team of nurses. This form provides a rapid screening opportunity in clinical practice and helps identify patients who need further evaluation (10).

It is the "Bladder Diary Form" used by healthcare professionals and patients to evaluate the severity of bladder symptoms and the effectiveness of treatment. The Bladder Diary Form is a form in which the patient can record all the liquids they drink for 24 hours, the amount of urine they expel, the frequency of urinary incontinence, and their urgency status. For this form to be used

effectively, nurses must provide detailed training to patients on how to fill out this form (11).

In the management of bladder dysfunction, the nurse's educator and consultant role is important in conservative methods (bladder training, lifestyle changes), pelvic floor muscle exercise (PTFE), and the use of clean intermittent catheters (12). It is recommended that patients go to the toilet by determining the frequency of urination in the bladder training given to gain behavioral changes after they wait as long as they can "hold/hold their urine" and increase this time to a level that they can tolerate every 4-5 days. With bladder training, it is expected to reduce the number of urination, incontinence, and sudden urination complaints in patients with overactive bladder. If the patients do not have a fluid restriction, a daily intake of 1.5/2 liters of fluid should be recommended. In addition, it should be recommended that the caffeine intake of patients with storage problems be below 100 mg/day (13). Patients should be informed to stay away from foods that irritate the bladder (extremely spicy foods, citrus fruits, tomatoes, etc.) and beverages (aspartame, caffeinated, carbohydrate drinks, alcohol, etc.) due to rapid stimulation of the bladder. It should be said that being at an ideal weight and quitting smoking will also have a positive effect on incontinence problems (14). Strengthening the pelvic floor muscles and bladder training also helps manage urinary problems (15). PFMT can be performed by the patients themselves with the use of contraction-relaxation techniques or with the use of assistive devices (vaginal cones, biofeedback, electrical nerve stimulation, etc.). There is no standard protocol for PFMT and exercises are created by the patient's condition. Therefore, the MS nurse should collaborate with the pelvic floor physiotherapist to determine the patient's appropriate pelvic floor muscle exercise program (16).

Drainage problems seen in PwMS may cause patients to use clean intermittent catheterization (CIC). CIC is a treatment method that preserves the upper urinary system function, provides low intravesical pressure, and shows positive acceleration in the patient's comfort if applied with the appropriate technique. Improper CIC application may cause complications such as urethral trauma, pain, and lower urinary tract infections in individuals (17). In addition, the residual urine volume should be measured and the presence of urinary tract infection (UTI) should be ruled out, since the increase in the residual urine amount due to the incomplete emptying of the bladder in the patient may reveal the risk of UTI (18). Corona et al. (19) reported that the frequency of urinary tract infections increased 7 times, the need to start an additional treatment for urinary symptoms, and the frequency of admission to the emergency department was higher in PwMS compared to drug treatment. Considering these results, regarding the use of CIC in MS patients by nurses; Training should be given to perform CIC as often as recommended by the physician, to pay attention to sterilization steps in catheter preparation, to ensure perineal hygiene, to use gloves during the application, and to ensure that the catheter is disposable. In addition, patients should be reminded that infections can trigger attacks and that they should protect themselves from urinary tract infections (19).

In PwMS, when conservative methods are not sufficient, it is recommended to use oral antimuscarinic drugs, beta-3

adrenoreceptors, or intravesical botulinum toxin A in the second step. PwMS should be informed about the side effects of antimuscarinics, such as constipation, dry mouth, vaginal dryness, headache, and blurred vision (20). Compliance with antimuscarinic drugs is very important in symptomatic treatment. Since the drug compliance levels of MS patients are generally low, the importance of regular use of these drugs should be explained to the patients. In addition, since it can be associated with conditions such as confusion and dementia due to its anticholinergic effect in patients with cognitive impairment, care should be taken for this patient group and the cognitive status of patients should be monitored (12).

In the management of bladder dysfunction, electrical nerve stimulation (neuromodulation) treatments are included in the third step. Neuromodulation treatments aim to ensure the coordination of the lower urinary system. Today, treatment options such as posterior/transcutaneous tibial nerve stimulation, intravaginal electrical stimulation, and sacral stimulation are widely used (21). In posterior tibial nerve stimulation (PTNS), one of the neuromodulation treatments, the posterior tibial nerve is the distal part of the sciatic nerve that exits the pelvis and descends to the lower extremities. Stimulation of this nerve provides retrograde neuromodulation to the sacral nerve plexus, which controls bladder function (22). It has been reported that percutaneous/transcutaneous tibial nerve stimulation is effective in alleviating the symptoms of overactive bladder in PwMS (23). Although the protocol of PTNS differs in studies, the stimulation application, which takes about 30 minutes in each session, is given using a negative electrode placed behind the medial malleolus and a positive electrode placed 10 cm above it. These electrodes are connected to an external neurostimulator that produces a current of 200 μ s width and a frequency of 10-20 Hz. Gradual increase in stimulation current is made until motor and sensory responses are achieved. Initially, percutaneous nerve stimulation is usually applied for 30 minutes/week/10-12 sessions; In patients who respond to treatment, treatment is continued at intervals according to the patient's condition. In studies conducted on PwMS, it has been reported that the PTNS method provides improvements in the amount of post-void residue, frequency of voiding, frequency of nocturia and urgency, and urodynamic finding (24,25). However, for this application, the patient must go to the hospital one or two days a week. In addition, there are some disadvantages such as the fact that the needles can cause pain in the application area, even if it is slight (22).

Transcutaneous tibial nerve stimulation (TTNS), on the other hand, is a non-invasive application that patients can easily use in their own environment when learned by nurses. TTNS is a method in which two superficial electrodes are placed in the medial malleolus at the ankle level where the tibial nerve is located. Studies are reporting that TTNS is effective in overactive bladder problems in PwMS (10,26). In TTNS application, is based on giving 20 minutes of electrical stimulation with two electrodes placed 2-3 cm behind the medial malleolus and parallel to it 5-10 cm above it. This application is cheaper, easier, and does not cause pain compared to PTNS (23).

Sacral neuromodulation (SNM) is the treatment of choice for patients with urinary retention or urge incontinence

unresponsive to conservative treatment and not related to urinary obstruction. In this procedure, a toothed wire is placed unilaterally into the S3 foramen before the permanent implant is placed. Test stimulation is performed before permanent implantation (27). Studies have reported that SNM provides significant improvements in postvoid residual, urinary frequency, incontinence frequency, and pad use in PwMS (28, 29). It seems that the SNM method can be helpful in the treatment of MS-related AAMS, but more randomized controlled studies are needed.

Bowel Dysfunction in Multiple Sclerosis

Bowel dysfunction (fecal incontinence and constipation) is one of the most common symptoms with a great impact on patients' comfort (30).

Fecal incontinence (FI) is defined by the International Continence Society (ICS) as the involuntary loss of liquid and/or solid stools (31). FI is caused by insufficient functioning of the sphincter due to neurological changes such as damage to the anal sphincter muscles and/or impaired perception of sensory stimuli from the anal canal. The prevalence of fecal incontinence in PwMS is reported to be in the range of 3-51%.

Constipation is defined as a common chronic gastrointestinal disorder characterized by bloating, agitation, abdominal pain, hard or lumpy stools, and a feeling of incomplete emptying and defecation less than 3 times a week. Constipation is seen in 18-43% of PwMS (32).

Management of Bowel Dysfunction and Nursing Care

When evaluating neurogenic bowel dysfunction in PwMS, a comprehensive voiding history should be obtained from the patient. Patients should be taught by nurses how to use the bowel diary form. A bowel diary form (daily defecation frequency, stool incontinence frequency, stool incontinence pattern, mean sleep, and waking time) can help determine the severity of symptoms and the factors affecting these symptoms by monitoring bowel symptoms over a one- to two-week period. In addition, the frequency of bowel movements, stool consistency (Bristol Stool Scale), gas incontinence, and the effectiveness of maneuvers applied for excretion management (such as digital anorectal stimulation, and rectal touch) should be evaluated comprehensively. In addition to these evaluations, standard measurement tools such as the Cleveland constipation score and St Mark's incontinence score can also be used (33).

Rectal examination is a vital assessment method that evaluates rectal filling, resting anal tone, and voluntary contraction of the anal sphincter. This assessment also provides information about the complications of chronic constipation such as anal fissures, complicated hemorrhoids, rectal bleeding, and prolapse (34).

Neurogenic bowel management progresses from conservative treatment options to invasive treatment options. Conservative treatment options (1st step-green) include diet & fluid intake, laxatives & antidiarrheals, digital stimulation, suppositories, and biofeedback methods; minimally invasive treatment options (2nd line-orange) include irrigation methods; Neuromodulation and surgical procedures are among the invasive treatment options (3rd step-red) (Figure 1) (33).

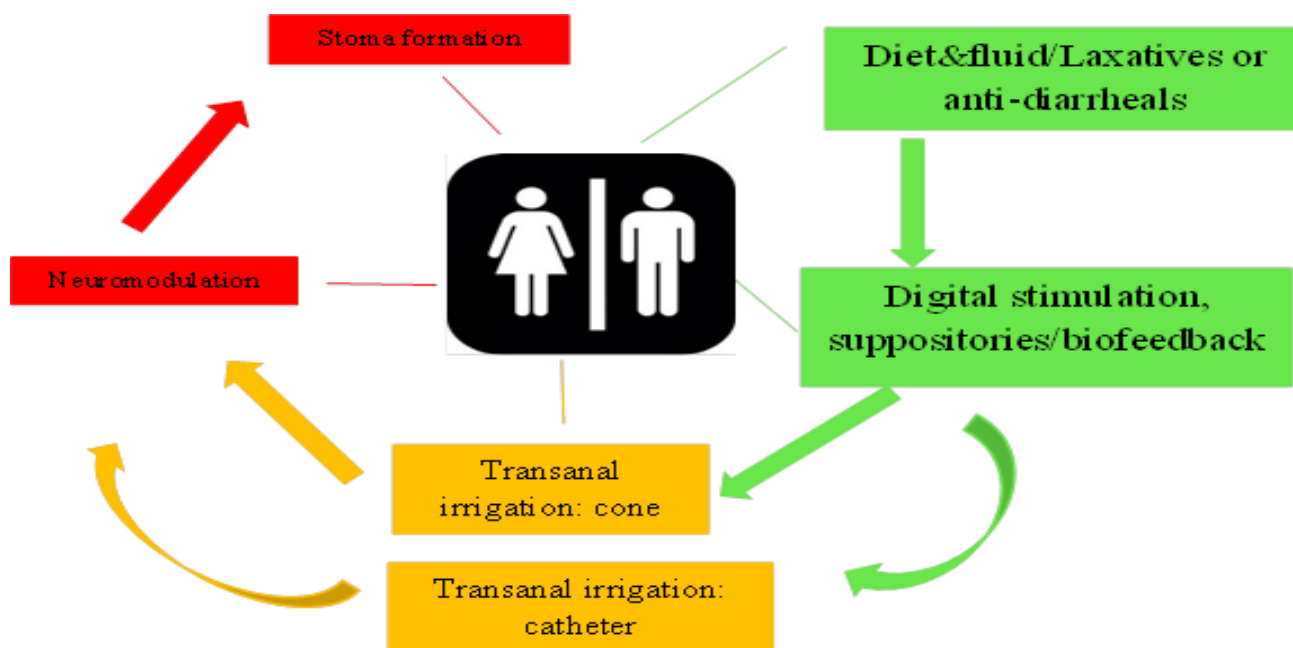


Figure 1. Neurogenic bowel management (33)

Font size reflects the frequency of treatment options used.

Color grading: green: conservative, orange: minimally invasive, red: invasive methods.

Bowel training provided by nurses is very important in conservative treatment. In the management of constipation experienced by PwMS, patients should be informed about increasing fluid intake, consuming foods high in pulp and fiber, exercising, and using laxatives, gastrokinetic agents, prosecretory agents, bile acid transporter inhibitors, biofeedback, and probiotics. Patients with fecal incontinence should be informed to avoid stool-softening products such as caffeinated beverages, alcohol, and foods containing sorbitol (33,35).

Regardless of the dietary content, the most important step is ensuring optimal intestinal motility and establishing a regular eating pattern. For constipation management, patients should establish a scheduled defecating routine on daily or alternate days (after waking up) and consume warm/hot beverages upon waking. Creating a favorable environment for the patient to achieve maximum success, privacy, comfort, and position during defecation (sitting position) are very important factors for intestinal efficiency (33).

Rectal taping can be used as an adjuvant technique to facilitate the evacuation of the patient. In the rectal touching technique, a sterile glove is worn, a finger is lubricated, the anus is entered and a bowel movement is provided by stimulating the recto-colic reflex with circular movements for 20-30 seconds. The rectal tapping method is the physical removal of feces that have accumulated in the rectum without contraction, using a hooking motion. Using the Valsalva maneuver simultaneously with rectal touch can also increase its effectiveness. Suppositories and enemas, such as bisacodyl (stimulant), leccarbon (carbon dioxide releasing), and glycerin (lubricant), can also help stimulate reflex contraction (36). Anal plugs, on the other hand, prevent gas and limited fecal incontinence in those with passive incontinence, and it is known to be highly

effective in patients with a decreased sense of anal sphincter control (37).

In cases where these applications are insufficient, Transanal irrigation (TAI) is recommended as a second-line treatment. The purpose of this treatment is to facilitate defecation by giving fluid to the rectum and colon with the help of a device from the anus. The TAI method provides regular emptying of the intestines in case of fecal incontinence and constipation, as well as restoring bowel function and providing the patient the opportunity to choose the time and place of defecation (38). The TAI method supports the regular evacuation of the rectosigmoid region and the transport of stool across the entire colon in patients with constipation problems. Thus, undesirable situations such as congestion can be prevented.

In addition to these treatment methods applied to patients, the positive effect of abdominal massage, which is one of the manual therapy methods, on neurogenic bowel dysfunction cannot be denied. Massage therapy is one of the oldest treatment methods known for centuries. It is the therapist's use of hands rhythmic movements on body tissues (including nerves and muscles) to achieve a specific goal. Abdominal massage, otherwise, is one of the types of massage that has the effect of stimulating parasympathetic activity and therefore the gastrointestinal response. Abdominal massage can be applied to reduce muscle tension, stimulate gastric acid secretion, increase appetite and bowel movements, and reduce stomach residual volume and abdominal bloating. It is known that PwMS experience constipation due to abnormality in gastrointestinal motility and the use of anticholinergics and antispasmodics. For this reason, manual (such as abdominal massage) or pharmacological interventions are applied to patients in case of constipation (39). In the study

conducted by McClurg et al. (40) to determine the feasibility of abdominal massage in the management of constipation in MS patients, the experimental group received abdominal massage for 15 minutes/day for 4 weeks, and the control group was advised to apply abdominal massage regularly. Although it was reported to be more effective in the experimental group compared to the control group, it was observed that defecation frequency and stool density increased in both groups, defecation time decreased, and abdominal massage was an effective approach to improving chronic constipation complaints in MS patients.

CONCLUSION

Bladder (storage and excretion problems) and bowel (fecal incontinence, constipation) dysfunction, which PwMS often experiences, significantly influence the comfort of patients. To eliminate these dysfunctions and improve patients' quality of life, various applications such as conservative, medical, and electrical stimulation methods should be used. The aim of MS nurses when providing care is to ensure that the patient empties their bladder before sleep, protects renal functions, prevents infection, and enhances the quality of life. In addition, it is to monitor the amount of fluid the patient takes in, to ensure that the patient maintains normal micturition function, and to plan and implement nursing care for this problem in case of any problem. In the management of dysfunction, which can be seen in PwMS from the time of diagnosis, MS nurses should undertake important roles and responsibilities in ensuring the compliance of the patients with their current treatment and monitoring their symptoms, as well as the bladder and bowel training given to the patients.

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REFERENCES

1. Frischer JM, Weigand SD, Guo Y, Kale N, Parisi JE, Pirko I, et al. Clinical and pathological insights into the dynamic nature of the white matter multiple sclerosis plaques. *Annals of neurology*. 2015; 78(5): 710-21.
2. Bölük C, Türk Börü Ü, Taşdemir M, Gezer T. Epidemiology of multiple sclerosis in Turkey; a ten-year trend in rural cities. *Turk J Neurol*. 2021; 27(1): 41-5.
3. Nazari F, Shaygannejad V, Mohammadi Sichani M, Mansourian M, Hajhashemi V. The prevalence of lower urinary tract symptoms based on individual and clinical parameters in patients with multiple sclerosis. *BMC Neurol*. 2020; 20(1): 24.
4. Panicker JN, Sakakibara R. Lower urinary tract and bowel dysfunction in neurologic disease. *Continuum: Lifelong Learning in Neurology*. 2020; 26(1): 178-99.
5. Fowler CJ, Griffiths D, de Groat WC. The neural control of micturition. *Nat Rev Neurosci*. 2008; 9(6): 453-66.
6. Villalba Bachur Roberto F, Kohan Diego F, Fernandez C Gaston, Angeloni Guido, Koren Claudio A, Longo Emilio M. Botulinum toxin type A in neurogenic overactive bladder dysfunction in patients with multiple sclerosis. *Urol Androl Open J*. 2021; 5(1): 10-4.
7. Haylen BT, Maher CF, Barber MD, Camargo S, Dandolu V, Digesu A, et al. An international urogynecological association (iuga) / international continence society (ics) joint report on the terminology for female pelvic organ prolapse (pop). *Int Urogynecol J*. 2016; 27(2): 165-94.
8. Seddone S, Marturano M, Bientinesi R, Lucchini M, Bassi P, Mirabella M, et al. Lower urinary tract disorders in multiple sclerosis patients: prevalence, clinical features, and response to treatments. *Neurourology and Urodynamics*. 2021; 40(6): 1500-8.
9. Lakin L, Davis BE, Binns CC, Currie KM, Rensel MR. A comprehensive approach to the management of multiple sclerosis: addressing invisible symptoms—a narrative review. *Neurology and therapy*. 2021; 10: 75-98.
10. Polat Dunya C, Tulek Z, Kürtüncü M, Panicker JN, Eraksoy M. Effectiveness of transcutaneous tibial nerve stimulation and pelvic floor muscle training with biofeedback in women with multiple sclerosis for the management of overactive bladder. *Multiple Sclerosis Journal*. 2021; 27(4): 621-9.
11. UrologyCareFoundation.org [Internet]. USA; American Urological Association. Overactive Bladder Diary. [Updated:2021; Cited:2023 March 20]. Available from: <https://www.urologyhealth.org/resources/Bladder-Diary>.
12. Cho ST, Kim KH. Pelvic floor muscle exercise and training for coping with urinary incontinence. *J Exerc Rehabil*. 2021; 17(6): 379-87.
13. Shah A, Panchal V, Patel K. Pathogenesis and management of multiple sclerosis revisited. *Disease-a-Month*. 2022; 69(9): 101497.
14. Tobin WO. Management of multiple sclerosis symptoms and comorbidities. *Continuum (Minneapolis)*. 2019; 25(3): 753-72.
15. Sparaco M, Bonavita S. Pelvic floor dysfunctions and their rehabilitation in multiple sclerosis. *Journal of Clinical Medicine*. 2022; 11(7): 1941.
16. Burton CS, Korsandi S, Enemchukwu E. Current state of non-surgical devices for female stress urinary incontinence. *Current Urology Reports*. 2022; 23(9): 185-94.
17. Grgar L. Prevention of catheter-related urinary tract infections: the octenidine hypothesis. *Medical Hypotheses*. 2020; 137: 109561.
18. Gray M, Wasner M, Nichols T. Nursing practice related to intermittent catheterization: a cross-sectional survey. *Journal of the wound, ostomy, and continence nursing: official publication of The Wound, Ostomy, and Continence Nurses Society*. 2019; 46(5): 418-23.
19. Corona LE, Sion NR, Cameron AP, Barboglio Romo PG, Stoffel JT. Intermittent catheterization and urinary tract infection in multiple sclerosis patients. *Can J Urol*. 2020; 27(4): 10294-9.
20. Zonic-Imamovic M, Imamovic S, Cickusic A, Delalic A, Hodzic R, Imamovic M. Effects of treating an overactive urinary bladder in patients with multiple sclerosis. *Acta medica academica*. 2019; 48(3): 271-7.

21. Rahnama'I MS. Neuromodulation for functional bladder disorders in patients with multiple sclerosis. *Multiple Sclerosis Journal*. 2020; 26(11): 1274-80.
22. Bhide AA, Tailor V, Fernando R, Khullar V, Digesu GA. Posterior tibial nerve stimulation for overactive bladder—techniques, and efficacy. *International urogynecology journal*. 2020; 31(5): 865-70.
23. Teoli D, An J. *Transcutaneous electrical nerve stimulation*. In: StatPearls. Treasure Island (FL): StatPearls Publishing; 2023.
24. Canbaz Kabay S, Kabay S, Mestan E, Cetiner M, Ayas S, Sevim M, et al. Long-term sustained therapeutic effects of percutaneous posterior tibial nerve stimulation treatment of neurogenic overactive bladder in multiple sclerosis patients: 12-months results. *Neurourology and urodynamics*. 2017; 36(1): 104-10.
25. De Seze M, Raibaut P, Gallien P, Even-Schneider A, Denys P, Bonniaud V, et al. Transcutaneous posterior tibial nerve stimulation for treatment of the overactive bladder syndrome in multiple sclerosis: results of a multicenter prospective study. *Neurourology and urodynamics*. 2011; 30(3): 306-11.
26. Díaz-Ruiz MDC, Romero-Galisteo RP, Arranz-Martín B, Palomo-Carrión R, Ando-Lafuente S, Lirio-Romero C. Vibration or transcutaneous tibial nerve stimulation as a treatment for sexual dysfunction in women with spinal cord injury: study protocol for a randomized clinical trial. *International Journal of Environmental Research and Public Health*. 2022; 19(3): 1478.
27. Uzunköprü C. Invasive therapies in multiple sclerosis. *Archives of Neuropsychiatry*. 2018; 55(Suppl 1), S21.
28. Fontaine C, Papworth E, Pascoe J, Hashim H. Update on the management of overactive bladder. *Therapeutic Advances in Urology*. 2021; 13: 17562872211039034.
29. Andretta E, Simeone C, Ostardo E, Pastorello M, & Zuliani C. Usefulness of sacral nerve modulation in a series of multiple sclerosis patients with bladder dysfunction. *Journal of the Neurological Sciences*. 2014; 347(1-2): 257-61.
30. Miget G, Tan E, Pericolini M, Chesnel C, Haddad R, Turmel N, et al. The neurogenic bowel dysfunction score (nbd) is not suitable for patients with multiple sclerosis. *The spinal cord*. 2022; 60(12): 1130-5.
31. D'Ancona C, Haylen B, Oelke M, Abranches-Monteiro L, Arnold E, Goldman H, et al. The International Continence Society (ICS) reports on the terminology for adult male lower urinary tract and pelvic floor symptoms and dysfunction. *Neurourol. Urodyn*. 2019; 38: 433-77.
32. Johns JS, Krogh K, Ethans K, Chi J, Querée M, Eng JJ, et al. Pharmacological management of neurogenic bowel dysfunction after spinal cord injury and multiple sclerosis: a systematic review and clinical implications. *Journal of Clinical Medicine*. 2021; 10(4): 882.
33. Emmanuel A. Neurogenic bowel dysfunction [version 1; peer review: 2 approved] F1000Research 2019, 8(F1000Faculty Rev):1800.
34. Bharucha AE, Knowles CH, Mack I. Fecal incontinence in adults. *Nature Reviews Disease Primers*. 2022; 8(1): 53.
35. Gulick EE. Neurogenic bowel dysfunction over the course of multiple sclerosis: a review. *International Journal of MS Care*. 2022; 24(5): 209-17.
36. Rodriguez GM, Gater DR. Neurogenic bowel and management after spinal cord injury: a narrative review. *J Pers Med*. 2022; 12(7): 1141.
37. Brown HW, Dyer KY, Rogers RG. Management of fecal incontinence. *Obstetrics & Gynecology*. 2020; 136(4): 811-22.
38. Teng M, Miget G, Moutounaïck M. Transanal irrigation for neurogenic bowel dysfunction in multiple sclerosis: a retrospective study. *Journal of neurogastroenterology and motility*. 2022; 28(2): 320-6.
39. Dehghan M, Malakoutikhah A, Heidari FG, Zakeri MA. The effect of abdominal massage on gastrointestinal functions: a systematic review. *Complementary therapies in medicine*. 2020; 54: 102553.
40. McClurg D, Hagen S, Hawkins S, & Lowe-Strong A. Abdominal massage for the alleviation of constipation symptoms in people with multiple sclerosis: a randomized controlled feasibility study. *Multiple Sclerosis Journal*. 2011; 17(2): 223-33.