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A Single Case Report of Sacral Nerve Stimulation in Neurogenic Bladder Dysfunction: A Physiotherapeutic Perspective

Dimpi Phukan[1,*], Deepjyoti Barman[1], Kangkan Talukdar[2], Ankur Jyoti Bora[3]

Abstract

Background: *This case study evaluates the effectiveness of sacral nerve stimulation (SNS) for improving neurological bladder function in a 34-year-old male patient, who underwent surgical intervention at the level of L4 for Conus Medullaris Syndrome. The patient presented with severe neurological deficits including bladder dysfunction.* ***Method:*** *Post-surgery, a targeted physiotherapy regimen, including faradic current stimulation to the sacral nerves (S2-S4) and conventional exercises was implemented to address bladder function. Pre- and post-intervention evaluations were carried out using Manual Muscle Testing (MMT) and the International Consultation on Incontinence Questionnaire-Urinary Incontinence Short Form (ICIQ-UI SF).* ***Result:*** *Notable improvements were seen: MMT scores rose from 0 to 3, and ICIQ-UI SF scores decreased from 20 to 9, indicating the potential effectiveness of SNS in treating neurogenic bladder dysfunction. The p-value was 0.046, which is below 0.05, confirming that the differences in MMT and ICIQ-UI SF scores are statistically significant.* ***Conclusion:*** *SNS demonstrated effectiveness in improving bladder function and quality of life for the patient. These results emphasize the value of incorporating SNS into clinical practice for individuals with neurogenic bladder dysfunction.*

Keywords: Sacral nerve stimulation (SNS), electrical muscle stimulator, neurogenic bladder dysfunction, pelvic floor exercises, urinary incontinence, manual muscle testing (MMT), the international consultation on incontinence questionnaire-urinary incontinence short form (ICIQ-UI SF)

INTRODUCTION

Neurogenic bladder dysfunction, commonly referred to as neurogenic bladder, refers to urinary bladder issues caused by diseases or injuries affecting the central nervous system or peripheral nerves responsible for regulating urination [1, 2]. The global annual incidence of spinal cord injuries leading to neurogenic bladder dysfunction is estimated to range from 12 to over 65 cases per million people [3].

The voluntary urination process involves bladder filling, storage, and emptying. The kidneys produce about 1.5 l of urine daily, which flows through the ureters into the bladder, where it is stored until it nears the typical bladder capacity of around 500 cc [4, 5].

The most common cause of neurogenic bladder is damage to the brain or spinal cord. Brain damage may result from conditions like stroke, brain

***Author for Correspondence**
Dimpi Phukan
E-mail: dimpiphukan097@gmail.com

[1]Master of Physiotherapy Scholar, Department of Physiotherapy, Jorhat Medical College, Jorhat, Assam, India
[2]Lecturer, Department of Physiotherapy, Jorhat Medical College, Jorhat, Assam, India
[3]Senior Physiotherapist Cum Course Coordinator, Department of Physiotherapy, Jorhat Medical College & Hospital, Jorhat, Assam, India

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tumors, multiple sclerosis, Parkinson's disease, multiple system atrophy, or other neurodegenerative disorders, with bladder involvement being more likely if the damage occurs in the pons area. Spinal cord damage can be caused by traumatic injury, demyelinating diseases, meningitis-retention syndrome, vitamin B12 deficiency, syringomyelia, cauda equina syndrome, or spina bifida [6]. Additionally, spinal cord compression from herniated discs, tumors, or spinal stenosis can lead to neurogenic bladder. Damage to peripheral nerves, which connect the spinal cord to the bladder, can also cause neurogenic bladder, typically the flaccid type. This nerve damage can be caused by conditions such as diabetes, alcoholism, vitamin B12 deficiency, or genital herpes, and may also occur as a complication of major pelvic surgeries, such as tumor removal [7].

Conus medullaris syndrome occurs when the conus medullaris and lumbar nerve roots are injured or damaged. It is characterized by severe back pain, perianal numbness, symmetrical weakness in the lower limbs, hyperreflexia, and early bowel and bladder issues. Surgical treatment for conus medullaris syndrome focuses on relieving compression of the spinal cord and nerve roots, often through decompression procedures like laminectomy or discectomy.

Sacral nerve stimulation, also known as sacral neuromodulation, is a therapy for neurogenic bladder that involves implanting an electrode to deliver low-level electrical impulses to the sacral nerves. This minimally invasive procedure has proven to have positive long-term results and is used to treat both bowel and/or bladder dysfunction [8]. Pelvic floor exercises can help strengthen the muscles and improve neuromuscular control in the pelvic region, potentially reducing or eliminating symptoms associated with pelvic floor dysfunction.

No previous studies have used an electrical muscle stimulator to provide sacral stimulation superficially, making this the first study of its kind. So, the primary aim of this case study is to evaluate the impact of sacral nerve stimulation which is given superficially on bladder function in a patient with neurogenic bladder dysfunction following surgery for Conus Medullaris Syndrome at the level of L4.

OBJECTIVE

The objective of the study is to assess the impact of sacral nerve stimulation on bladder control and quality of life in neurogenic bladder dysfunction.

PATIENT PROFILE AND HISTORY

A 34-year-old male patient presented with significant neurological symptoms following a recent surgery for Conus Medullaris Syndrome at Jorhat Medical College & Hospital, Jorhat, Assam.

According to the patient, since 1 year ago, he experienced pain in his lower back, pins and needle and pulling sensation in the back of his lower limbs bilaterally. However, since December 2023, the pain intensified and there was increased pulling sensation felt in both the back of his lower limbs. On 16th April, 2024, he received Injection Tramadol and Methylcobalamin for the pain. 2 h later, he felt no sensation over his buttocks, posterior aspect of his legs and was unable to sense the passing of stool and urine. Consequently, he was admitted to Jorhat Medical College and Hospital on 18/04/2024, where various tests were conducted, followed by surgery. The surgery performed was L4 Laminectomy, Flavectomy, left L4 Foraminotomy and Transforaminal discectomy on his lower back on 19th April, 2024. Despite the surgery, he remains unable to feel his buttocks, bowel and bladder, and the back side of his thigh bilaterally. This resulted in a dependence on an indwelling catheter for bladder management.

EXAMINATION

Initial evaluation included comprehensive assessment including baseline bladder function, sensory and motor status, and overall health status.

According to International Standards for Neurological Classification of Spinal Cord Injury (ISNCSCI), following details are observed (Tables 1–5):

There was an absence of bladder filling and voiding sensation. The patient was placed on an indwelling catheter for continuous bladder drainage.

MRI of lumbo-sacral spine showed focal Intradural lesion (10×6 mm) seen in opposite L4 body causing compression of cauda roots, decreased spinal canal AP dimension (9.6 mm), central and bilateral paracentral disc protrusion indenting the thecal sac at L4-L5 level causing bilateral neural foraminal narrowing (Figure 1).

Table 1. Motor strength testing (myotome).

	Right	**Left**
L2	4	4
L3	4	4
L4	4	4
L5	4	4
S1	2	2

Table 2. Sensory light touch testing.

	Right	**Left**
T12	1	1
L5	1	1
S1	1	1
S2	0	0
S3	0	0
S4	0	0
S5	0	0

Table 3. Sensory pin prick sensation.

	Right	**Left**
T12	2	2
L5	1	1
S1	1	1
S2	0	0
S3	0	0
S4	0	0
S4	0	0

Table 4. Reflex testing.

	Right	**Left**
Upper abdominal reflex (T9-T10)	Present	Present
Lower abdominal reflex (T10-T12)	Absent	Absent
Knee jerk	Exaggerated	Exaggerated
Ankle jerk	Absent	Absent

METHODOLOGY

This is a single case study of a 34-year-old male patient presented with significant neurological symptoms including neurological bladder dysfunction following a recent surgery for Conus Medullaris Syndrome at Jorhat Medical College & Hospital, Jorhat, Assam. The patient was given proper information regarding the interventions and consent form was signed. The intervention started from 27/04/24, 9 days post-operatively. The study spans a duration of 14 days. The data collection of the study is conducted on day-0 to establish a reference point, day-4 and day-8 to capture early responses and day-14 to gain insight into sustained effects.

Physiotherapy Intervention

Conventional Exercises

Pelvic floor exercises, including Kegel's (10-second isometrics with normal breathing), were taught to the patient in supine, sitting, and standing positions.

Frequency

Daily sessions for 14 days from 27/04/24 to 10/05/24.

Table 5. EMS protocol.

Type of Stimulation	Faradic current stimulation
Electrodes Placement	Electrodes were strategically placed to target the sacral nerves, specifically S2-S4, which are involved in bladder control (Figures 2 and 3)
Current Parameters	Surged faradic current with pulse duration of 100 μsec.
Intensity	Adjusted based on patient comfort and therapeutic response
Duration	Each session lasted 30 min, with stimulation alternating between the sacral region (15 min on each side) and bladder area (15 min on each side).
Frequency	Daily sessions for 14 days from 27/04/24 to 10/05/24 were conducted to maintain consistent stimulation and monitor patient responses.

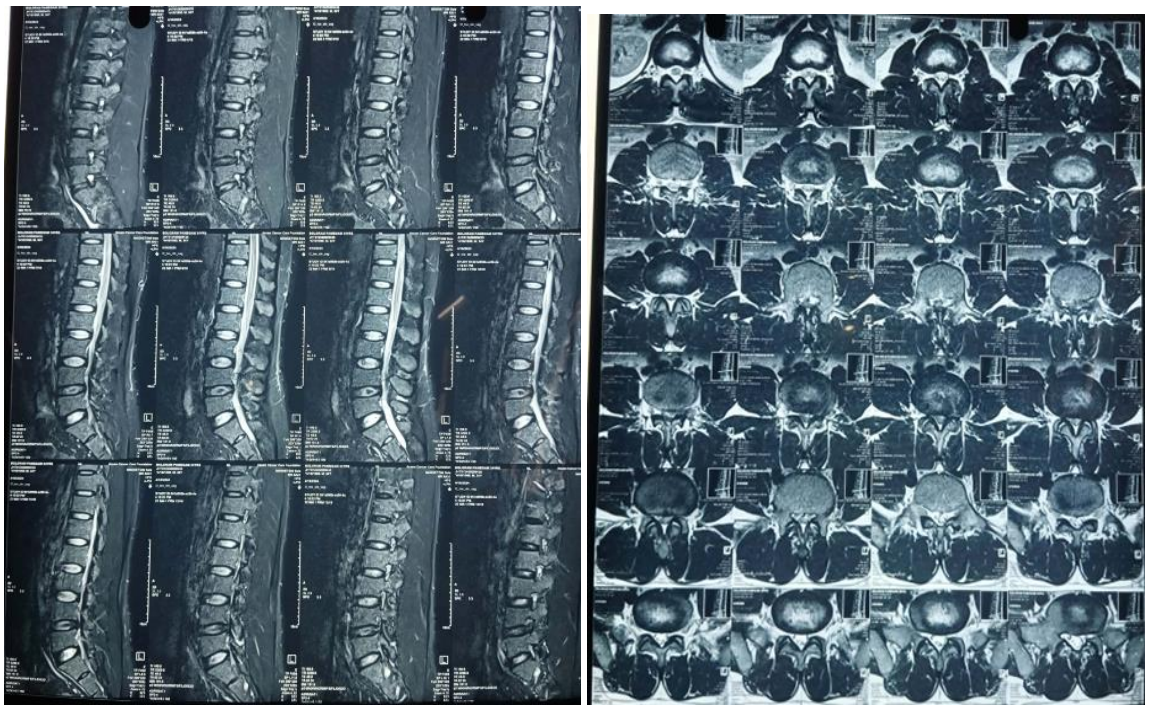

Figure 1. MRI of lumbo-sacral spine (pre surgery).

Figure 2. Electrode placement over sacral region.

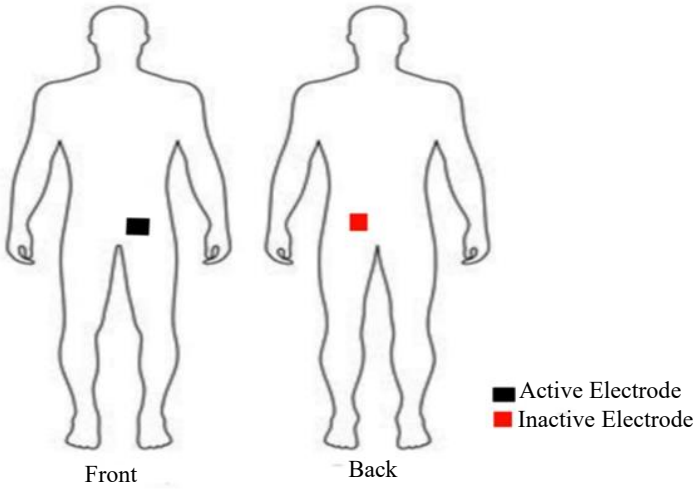

Figure 3. Electrode placement over bladder.

Outcome Tools

The pelvic floor muscle strength examination was conducted using Manual Muscle Testing (MMT). The reliability of MMT grades for individualized groups ranges from 0.65–0.93 [9].

The International Consultation on Incontinence Questionnaire-Urinary Incontinence Short Form (ICIQ-UI SF) is designed to evaluate urinary incontinence and its effect on quality of life (QoL). Research shows a Cronbach's alpha of 0.75, a Kappa Index of 0.70 for test-retest reliability, a Pearson Correlation Coefficient of 0.93, and an intra-class correlation coefficient of 0.84 [10].

RESULTS

The pre and post treatment values are computed using Statistical Package for Social Sciences (SPSS) software. There is improvement in the Manual Muscle Testing scores from 0 to 3 and International Consultation on Incontinence Questionnaire-Urinary Incontinence Short Form scores from 20 to 9 respectively from day-0 till day-14. Figures 4 and 5 represent the MMT and ICIQ-UI SF scores over time (Table 6).

The patient experienced gradual sensory recovery in the bladder, with improved sensation in previously numb areas, particularly in the S2-S4 dermatomes. This led to enhanced bladder control, marked by a significant reduction in urinary incontinence and decreased dependency on catheterization, eventually allowing for natural voiding. These improvements contributed to a better quality of life, with the patient reporting increased comfort, reduced anxiety regarding bladder management, and enhanced overall satisfaction. Additionally, gains in daily activities were observed, reflecting improved mobility and independence.

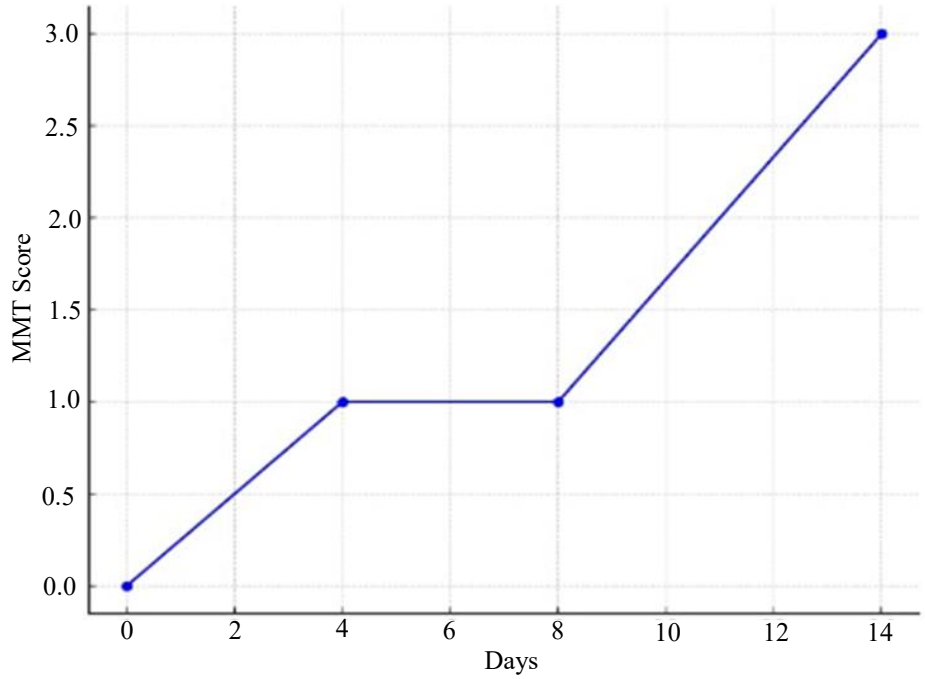

Figure 4. MMT scores.

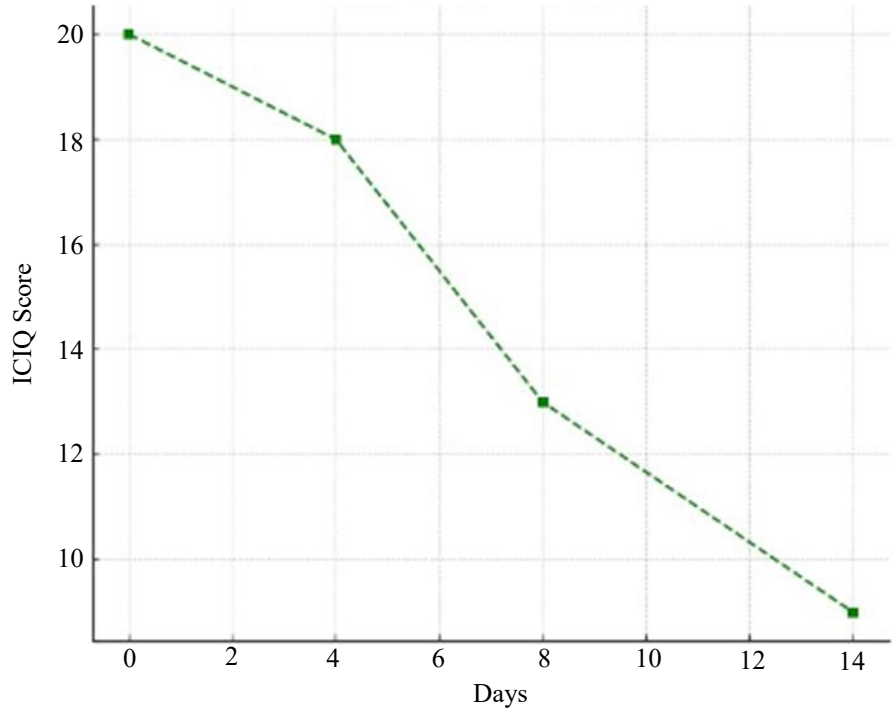

Figure 5. ICIQ-UI SF scores.

Table 6. Manual muscle testing scores.

Outcome tools	Day-0	Day-4	Day-8	Day-14
Manual Muscle Testing	0	1	1	3
ICIQ-SF	20	18	13	9

The Friedman's two-way analysis of variance by ranks test was conducted to determine whether the differences in the scores of MMT and ICIQ-UI SF are statistically significant. Here, the p-value was found out to be 0.046, which is less than 0.05 concluding that the difference in scores of MMT and ICIQ-UI SF are statistically significant.

DISCUSSION

The primary objective of the study is to assess the impact of sacral nerve stimulation on bladder control and quality of life in neurogenic bladder dysfunction. The study was done for a duration of 14 days and in this case study we observe significant improvement in the MMT and ICIQ-UI SF scores.

Sacral Nerve Stimulation (SNS) is a neuromodulation technique that targets the sacral nerve roots (S2-S4) to treat various bladder and bowel dysfunctions. The primary mechanism involves the delivery of electrical impulses that modulate the activity of these nerve roots, influencing the reflex pathways that control bladder and bowel functions. This modulation restores normal activity by enhancing communication between the bladder, bowel, and central nervous system [11]. SNS has been associated with a marked reduction in urinary incontinence episodes and improved bowel control, particularly in patients with fecal incontinence. A systematic review showed that SNS significantly decreases reliance on catheterization and enhances overall bladder and bowel management [12, 13]. The American Society of Colon and Rectal Surgeons has recognized SNS as an effective treatment option for fecal incontinence, highlighting its role in improving patient outcomes [14].

SNS promotes neuroplasticity, allowing the nervous system to reorganize and recover lost functions, particularly in patients with neurological impairments. Studies indicate that SNS can inhibit pathological reflexes contributing to bladder and bowel dysfunction, thus enhancing overall regulation of these systems [11]. The ability of SNS to modify afferent signaling pathways suggests that it can effectively alter the perception of bladder fullness and urgency, leading to improved symptom management [13]. Patients often report enhanced sensory perception and increased awareness of bladder fullness, indicating effective targeting of sensory pathways. This sensory recovery is crucial for patients with conditions like overactive bladder [11].

Patients undergoing SNS frequently report higher satisfaction levels and better overall quality of life. The alleviation of symptoms related to bladder and bowel dysfunction contributes to enhanced daily functioning and well-being. The psychological benefits of reduced incontinence episodes and improved control over bodily functions are significant, as they lead to increased confidence and social participation [12, 15].

While pharmacological treatments primarily manage symptoms, SNS offers a more direct influence on neural mechanisms, leading to more sustained improvements in bladder and bowel function with fewer systemic side effects. Medications often come with adverse effects that can affect patient adherence, whereas SNS provides a targeted approach that can lead to long-term symptom relief [11, 13]. Traditional surgical options for bladder and bowel dysfunction often involve higher risks and longer recovery times. SNS is less invasive and can serve as a complementary treatment to surgical interventions, addressing both functional and structural aspects of dysfunction. The minimally invasive nature of SNS allows for quicker recovery and less postoperative discomfort compared to more invasive surgical procedures [11, 14].

A case study assessed the effectiveness of combining faradic and neuromuscular electrical stimulation to enhance sensory and motor function of the bladder and bowel in pediatric patients with

spina bifida and myelomeningocele. Bladder control improved by 40%, while bowel control increased by 20%. All participants showed improved bladder sensation, and 80% experienced improved bowel sensation. Additionally, using surged faradic stimulation on the pelvic floor muscles as part of conservative treatment in children with idiopathic rectal prolapse led to the complete resolution of even long-standing rectal prolapse [16]. Post-operative patients with cauda equine syndrome have shown improvement in urinary retention following a patient-specific physiotherapy treatment plan which included pelvic floor exercises and surface faradic electrical stimulation [17].

Sacral neuromodulation (SNS) modifies nerve signals to decrease involuntary bladder contractions and improve pelvic floor muscle coordination, leading to enhanced bladder function. Furthermore, combining electrical stimulation with Kegel exercises likely helps strengthen pelvic muscles, resulting in improved Manual Muscle Testing (MMT) and International Consultation on Incontinence Questionnaire-Urinary Incontinence Short Form (ICIQ-UI SF) scores. Patients receiving SNS often report higher satisfaction and an overall better quality of life. The alleviation of symptoms related to bladder and bowel dysfunction contributes to enhanced daily functioning and well-being. The psychological benefits of reduced incontinence episodes and improved control over bodily functions further contribute to improved quality of life. Studies consistently demonstrate that patients experience less anxiety, depression, and social isolation after SNS treatment.

The observed sensory recovery, reduced reliance on catheterization, and enhanced quality of life emphasize the value of SNS as a treatment option. The potential for SNS to restore neurological control over bladder and bowel functions provides hope for individuals dealing with these challenges.

LIMITATIONS AND FUTURE RECOMMENDATIONS

This study focuses on the outcomes of just one patient, which restricts the generalizability of the findings. The findings may not fully represent the experiences of all individuals with neurogenic bladder dysfunction. Further research with a larger sample size is needed to verify the effectiveness of superficial sacral stimulation.

CONCLUSION

The patient’s recovery, characterized by significant improvements in bladder function and sensory perception following superficial sacral stimulation highlight the importance of considering SNS in clinical practice for patients with neurogenic bladder dysfunction. This case study adds to the increasing body of evidence highlighting the effectiveness of Sacral Nerve Stimulation in enhancing bladder function and improving quality of life for patients with neurogenic bladder.

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Conflicts of Interest

There are no conflicts of interest.

REFERENCES

1. Abedi A, Heesakkers J, Zong H, Wang W, D’Ancona C, Yamaguchi O, et al. Health care economic burden of treatment and rehabilitation for neurogenic lower urinary tract dysfunction: a systematic review. J Urol. 2022; 208(4): 773–783.
2. Suskind AM. Neurogenic bladder. In: McAninch JW, Lue TF, editors. Smith & Tanagho's General Urology. 19th Edn. New York: McGraw Hill; 2020.

3. Hamid R, Averbeck MA, Chiang H, Garcia A, Al Mousa RT, Oh SJ, et al. Epidemiology and pathophysiology of neurogenic bladder after spinal cord injury. World J Urol. 2018; 36(10): 1517–27.
4. Fitzgerald MP, Stablein U, Brubaker L. Urinary habits among asymptomatic women. Am J Obstet Gynecol. 2002; 187(5): 1384–8.
5. Latini JM, Mueller E, Lux MM, Fitzgerald MP, Kreder KJ. Voiding frequency in a sample of asymptomatic American men. J Urol. 2004; 172(3): 980–4.
6. Bacsu CD, Chan L, Tse V. Diagnosing detrusor sphincter dyssynergia in the neurological patient. BJU Int. 2012; 109(Suppl 3): 31–4.
7. Dorsher PT, McIntosh PM. Neurogenic bladder. Adv Urol. 2012; 2012: 816274. doi:10.1155/2012/816274.
8. Goldman HB, Lloyd JC, Noblett KL, Carey MP, Castaño Botero JC, Gajewski JB, Lehur PA, Hassouna MM, Matzel KE, Paquette IM, de Wachter S, Ehlert MJ, Chartier-Kastler E, Siegel SW. International Continence Society best practice statement for use of sacral neuromodulation. Neurourol Urodyn. 2018;37:1823–48. DOI: https://doi.org/10.1002/nau.23515.
9. Cuthbert SC, Goodheart GJ Jr. On the reliability and validity of manual muscle testing: a literature review. Chiropr Osteopat. 2007; 15: 4.
10. Hajebrahimi S, Nourizadeh D, Hamedani R, Pezeshki MZ. Validity and reliability of the International Consultation on Incontinence Questionnaire-Urinary Incontinence Short Form and its correlation with urodynamic findings. Urol J. 2012; 9(4): 685–90.
11. Wang X, Chen JDZ. Therapeutic potential and mechanisms of sacral nerve stimulation for gastrointestinal diseases. J Gastroenterol. 2023; 58(1): 1–12.
12. Miller JA, et al. Sacral nerve stimulation for fecal incontinence: a systematic review and meta-analysis. Dis Colon Rectum. 2016; 59(3): 227–34.
13. Coolen RL, Groen J, Blok B. Electrical stimulation in the treatment of bladder dysfunction: technology update. Med Devices (Auckl). 2019; 12: 337–45.
14. Bordeianou LG, Thorsen AJ, et al. The American Society of Colon and Rectal Surgeons Clinical Practice Guidelines for the Management of Fecal Incontinence. Dis Colon Rectum. 2023; 66(5): 647–61.
15. Alzayer T. The effect of using a combined electrical stimulation therapy on improving sensory and motor functions of the bladder and the bowel in children with myelomeningocele: a case series. SAGE Open Med Case Rep. 2024; 12: 1–6.
16. Ratan SK, Rattan KN, Jhajhria P, Mathur YP, Jhanwar A, Kondal D. The surged faradic stimulation to the pelvic floor muscles as an adjunct to the medical management in children with rectal prolapse. BMC Pediatr. 2009; 9: 44.
17. Redij S, Ambolkar A, Kenkre G. Effectiveness of pelvic floor exercises along with faradic stimulation on bladder retention and quality of life in post-operative case of cauda equina syndrome. Acta Sci Orthop. 2022; 5(3): 42–7.

