DEVELOPMENT AND VALIDATION OF NEUROGENIC BLADDER ASSESSMENT QUESTIONNAIRE IN SPINAL CORD INJURY

By

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Dissertation Submitted to the

Odisha University of Health Sciences, Bhubaneswar, Odisha

In Partial Fulfilment

Of the requirements for the degree of

MASTERS OF PHYSIOTHERAPY (MPT)

IN

NEUROLOGY

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BHUBANESWAR, ODISHA

2023-2025

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ACKNOWLEDGEMENT

I would like to express my heartfelt gratitude to Almighty, my family and friends for their unwavering encouragement, understanding, and love. Their support has been a constant source of strength during this academic journey.

I extend my sincere gratitude and appreciation to the management and administration of Abhinav Bindra Sports Medicine and Research Institute, Bhubaneswar, and those who have supported and guided me throughout the journey of this dissertation. Without their valuable contributions, this work would not have been possible.

I am also immensely grateful to Dr. Chinmaya Kumar Patra, the Principal, Abhinav Bindra Sports Medicine and Research Institute, Bhubaneswar. His encouragement and belief in my abilities have been a source of motivation and confidence.

I would like to express my sincere gratitude to my dissertation guide, Dr. Chinmaya Kumar Patra, the Principal, and Co-guide Dr. Asma Parveen, Assistant Professor, Abhinav Bindra Sports Medicine and Research Institute, Bhubaneswar. Their unwavering support, expert guidance, and insightful feedback have been instrumental in shaping this research. Their dedication to excellence in academia has inspired me to strive for higher goals in my academic pursuits.

Furthermore, I would like to extend special thanks to Dr. Deepak Kumar Pradhan for his valuable assistance and support throughout this research. His expertise and constructive criticism have helped me refine my work and explore new dimensions in my study. I am also thankful to all the faculty members, staff, fellow students and subjects who have contributed to my academic growth and provided a supportive environment for learning. A special thanks to Dr. Kishoremoy Das, Assistant Professor, Saveetha College of Physiotherapy.

In conclusion, this dissertation stands as a testament to the collaborative efforts of the individuals mentioned above, and I am deeply grateful for their contributions to my academic success.

Thank you.

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LIST OF ABBREVIATIOB USED

1. **AD** – Autonomic Dysreflexia
2. **CIC** – Clean Intermittent Catheterization
3. **DSD** – Detrusor Sphincter Dyssynergia
4. **I-CVI** – Item Content Validity Index
5. **LMN** – Lower Motor Neuron
6. **LUT** – Lower Urinary Tract
7. **NBAQ**-Neurogenic Bladder Assessment Questionnaire
8. **NLUTD** – Neurogenic Lower Urinary Tract Dysfunction
9. **PMC** – Pontine Micturition Centre
10. **PVR** – Post-Void Residual
11. **S-CVI** – Scale Content Validity Index
12. **SCI** – Spinal Cord Injury
13. **UMN** – Upper Motor Neuron
14. **UTI** – Urinary Tract Infection

ABSTRACT

TITLE: DEVELOPMENT AND VALIDATION OF NEUROGENIC BLADDER ASSESSMENT QUESTIONNAIRE IN SPINAL CORD INJURY

Background: Spinal cord injury (SCI) refers to damage of the spinal cord that may lead to partial or complete loss of motor, sensory, and autonomic function, either temporarily or permanently. Among its complications, neurogenic bladder dysfunction is highly prevalent and significantly impacts health and quality of life. The most common types of bladder impairment in SCI are: upper motor neuron (UMN) bladder (automatic bladder), lower motor neuron (LMN) bladder (autonomous bladder), and mixed type. Although urodynamic studies remain the gold standard for diagnosis, there is a lack of simple, structured assessment tools to classify bladder type in clinical practice. A patient-reported questionnaire could enhance diagnostic accuracy and facilitate targeted bladder management strategies.

Objective: To develop and validate a neurogenic bladder assessment questionnaire in non-catheterized SCI patients.

Methods: The questionnaire was developed using a multi-step approach. A comprehensive literature review identified key domains of neurogenic bladder dysfunction in SCI. Draft items were generated and refined through expert panel review to ensure clarity and relevance. The preliminary version was pilot-tested on 30 non-catheterized SCI patients to assess feasibility. Content validity was

evaluated using expert ratings on a 4-point scale, with item-level (I-CVI) and scale-level (S-CVI/Ave, S-CVI/UA) indices calculated.

Results: The final questionnaire contained 18 items. Expert evaluation showed high content validity, with I-CVI values ranging from 0.83–1.0, S-CVI/Ave of 0.97, and S-CVI/UA of 0.83The tool's clarity, relevance, and viability for patient use were validated by pilot testing.

Conclusion: The *Neurogenic Bladder Assessment Questionnaire in Spinal Cord Injury (Without Catheterisation)* showed excellent content validity and feasibility. For non-catheterized SCI patients, this structured, symptom-based diagnostic tool offers a useful, non-invasive way for classifying bladder impairment. In clinical and research settings, it may improve diagnostic accuracy, facilitate tailored treatment, and function as a standardised assessment tool.

Keywords: Bladder dysfunction; Catheterization; Quality of life; SCI; Urodynamics.

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INTRODUCTION

"A spinal cord injury (SCI) is damage to the spinal cord that causes temporary or permanent changes in its function. It is a destructive neurological and pathological state that causes major motor, sensory and autonomic dysfunctions" (Anam Anjum et.al 2020)[1.] "The most common SCI cause is acute trauma from motor vehicular crashes (MVCs), although the condition may also arise from insidious etiologies such as malignancies and chronic tuberculous infection" (Margetis et.al2025)[3]. "Globally, over 15 million people are living with SCI" (WHO 2024)[2]. Spinal cord injuries often bring about serious complications, particularly affecting the urinary system. The most common issues include urinary tract infections (UTIs), damage to the bladder or kidneys, and the development of stones. One of the first and most crucial steps after an SCI is establishing a reliable method for bladder management. However, this can be complex, as it depends on several personal factors such as gender, lifestyle, hand function, and access to healthcare.[3]

"Neurogenic bladder is a term used to define bladder and urinary sphincter malfunctioning those results from some change in the central nervous system (CNS) and/or peripheral nervous system" (Truzzi JC 2021).[4] Individuals with neurogenic bladder dysfunction may experience problems with bladder filling, voiding, or both. The severity of this condition varies and is influenced by several factors, including the location, type, extent, and progression of the neurological injury. Urinary symptoms may greatly impact daily living, with urinary incontinence being one of the most prominent and distressing issues.[4]

"

In the United States, neurogenic bladder

affects 40–90% of persons with multiple sclerosis, 37–72% of those with Parkinsonism, and 15% of those with stroke. Detrusor hyperreflexia is seen in 50–90% of persons with multiple sclerosis, while another 20–30% have detrusor areflexia. There are more than 200,000persons with spinal cord injuries, having bladder dysfunction" (Dorsher PT et.al 2012). [5] "The prevalence of neurogenic bladder for the general population is unknown; it is estimated that 70–84% of SCI patients are impacted by some degree of bladder dysfunction" (Miller CA 2021). [6] Neurogenic lower urinary tract dysfunctions (NLUTD) commonly present with symptoms such as urinary urgency, frequency, hesitancy, intermittency, incomplete bladder emptying, and incontinence. The specific type and severity of these symptoms depend on the location and extent of the underlying neurological lesion. Lesions located above the pontine micturition centre (suprapontine lesions) are typically associated with storage dysfunction due to detrusor overactivity. In contrast, injuries affecting the sacral or infrasacral spinal cord often result in voiding difficulties caused by detrusor areflexia. Lesions situated between these two regions—specifically infrapontine and suprasacral—are commonly linked to detrusor-sphincter dyssynergia.[6] These urinary symptoms can significantly affect a patient's well-being, often leading to embarrassment, reduced social interaction, and a considerable decline in quality of life.[6]

NORMAL MICTURATION

Urination, also known as micturition, is a vital physiological process that allows the body to eliminate metabolic waste products and toxins filtered by the kidneys. "The bladder's main role is to store and release urine. For individuals with a bladder capacity of 400–600 mL, urination typically occurs every 3 to 4

hours, meaning the bladder remains in its storage phase for over 99% of the time" (Hao J et.al 2025).[9] The initiation of urination is a conscious process, shaped by the perception of bladder filling and the appropriateness of the surroundings. Effective voiding requires proper signalling and integration between the central and peripheral nervous systems [9]. Any disruption in this intricate control system may result in various disorders like, loss of bladder control and difficulty in voiding, and other urological complications.[10]

Understanding the physiology of normal urination is essential for effectively managing these disorders. Several key issues can affect the urinary system. Incontinence, or the involuntary loss of urine, impacts individuals of all ages, while urinary retention, the inability to completely empty the bladder, can cause discomfort and increase the risk of infections. Overactive bladder leads to frequent and urgent urination, often interrupting daily activities. Other common problems include hesitancy (difficulty initiating urination), painful urination (usually linked to infections or inflammation), and structural or neurological abnormalities.[7] Hormonal changes, especially during menopause, certain medications, and inadequate hydration can also impair normal urinary function. Effective treatment involves a thorough diagnosis and individualized management plan to enhance functional ability and overall well-being.[7]

The anatomy of the urinary system is divided into the upper and lower tracts. The upper tract includes the kidneys and ureters, while the lower tract consists of the bladder and urethra. Histologically, the urinary tract is lined with a specialized transitional epithelium known as urothelium, which includes glycoproteins called uroplakins. These provide a protective barrier, especially in areas like the bladder, which undergo significant stretching during filling and

emptying. The bladder also contains umbrella cells—large, multinucleated superficial cells—that form tight junctions and maintain the mucosal barrier during bladder distension.[7]

The urinary system begins developing early in embryogenesis. The pronephros appears around the fourth week of gestation but is nonfunctional.[7]It is followed by the mesonephros, which functions temporarily until the tenth week. The metanephros emerges around week five and becomes the permanent kidney, fully functional by week ten. This structure consists of the metanephric mesenchyme, which forms nephrons, and the ureteric bud, which gives rise to the collecting ducts, renal pelvis, and ureters.[7]

Functionally, the bladder serves as both a storage reservoir and a contractile organ that expels urine through the urethra. It has three interwoven muscle layers—two longitudinal (inner and outer) and one circular (middle). “The bladder can store increasing volumes of urine while maintaining low pressure, a property known as compliance. Normal compliance ranges from 12.5 to 40 mL/cm H_2O” (cortes GA et.al 2020).[7] A loss of bladder compliance can result from neurological damage, infections, radiation, or chronic outlet obstruction and can lead to symptoms like urgency and incontinence. Management includes pharmacological treatment and, in some cases, surgical intervention.[7]

“The regulation of micturition involves multiple neural pathways. During the storage phase, sympathetic nerves originating from the T11–L2 spinal segments travel through the hypogastric nerve” (cortes GA et.al 2020).[7] These nerves release noradrenaline, which relaxes the bladder muscle via β3 adrenergic receptors and contracts the internal sphincter via α1 receptors. Simultaneously,

somatic nerves from S2–S4 via the pudendal nerve stimulate the external urethral sphincter through nicotinic cholinergic receptors, promoting urine retention. The pontine storage centre in the brainstem helps maintains this coordination.[7]

“A specific protective reflex known as the "guarding reflex" maintains continence during sudden increases in abdominal pressure, such as during coughing or sneezing. This reflex involves stretch-sensitive receptors in the bladder wall that send signals to Onuf’s nucleus in the sacral spinal cord, triggering external sphincter contraction” (cortes GA et.al 2020).[7]

When voiding is initiated, afferent signals from the bladder activate the pontine micturition centre (Barrington’s nucleus), which suppresses the guarding reflex. This results in a shift from sympathetic to parasympathetic control. “Parasympathetic fibres from S2–S4 travel via pelvic nerves and release acetylcholine, which binds to M3 muscarinic receptors in the bladder wall, causing detrusor muscle contraction. The pelvic floor and external sphincter muscles relax voluntarily, enabling urine flow. In cases where the spinal cord is damaged below the pontine centre, coordination between bladder contraction and sphincter relaxation can be lost, a condition known as detrusor-sphincter dyssynergia” (cortes GA et.al 2020).[7]

PATHOPHYSIOLOGY

“The spinal cord serves as the main control centre for urination, regulating the activities of the detrusor muscle, internal urethral sphincter (IUS), and external urethral sphincter (EUS). [32] It also acts as a communication hub between the bladder, urethra, and the pontine micturition centre (PMC), which is located in

the pons. The PMC initiates bladder emptying by signalling detrusor contraction and IUS relaxation through the spinal cord. However, the cerebral frontal cortex keeps the PMC inhibited to allow bladder filling until it is appropriate to void.[32]

Within the spinal cord, the primary voiding centre comprises three key components: the sympathetic nerve centre (SNC), the parasympathetic nerve centre (PNC), and the nucleus accumbens.[10] These structures send nerve fibres to control bladder and urethral functions. The SNC, located between T10 and L2, facilitates bladder filling by activating α1-adrenergic receptors in the bladder neck and β3-adrenergic receptors in the bladder base, which relax the detrusor muscle.[10] The PNC, on the other hand, is located in the S2 to S4 segments and promotes urination by stimulating M3 cholinergic receptors in the detrusor muscle through the pelvic splanchnic nerves. The EUS, innervated by somatic nerves via the pudendal nerve (also from S2–S4), plays a role in voluntary urination control.[10]

"Damage to the nerves in the pubic region may reduce bladder capacity and increase urinary frequency" (Hao J, et al. 2025) [9]. "The EUS helps retain urine, but if it contracts involuntarily along with the detrusor, it can cause detrusor-sphincter dyssynergia, although this is rare in neurogenic bladder related to lumbar spine disorders. Finally, sensory input from the bladder wall, including stretch and pain signals, is transmitted to the sacral spinal cord via the PNC, which is crucial in initiating the process of voiding" (Stoffel JT 2016). [33]

BLADDER IN SPINAL SHOCK PHASE

Spinal shock typically follows an acute spinal cord injury (SCI) and may persist for up to three months. During this phase, the parasympathetic nerves

responsible for autonomic bladder control become nonfunctional, leading to an atonic bladder and a lack of sensation related to bladder filling. Because the spinal cord pathways below the pons are disrupted, the micturition reflex is lost, resulting in urinary retention. “Urodynamic testing should be delayed until the spinal shock phase has resolved. In the meantime, urinary retention should be managed using clean intermittent catheterization (CIC) or an indwelling catheter. Once spinal shock subsides, reflex bladder activity may resume, often characterized by involuntary and uncoordinated bladder contractions” (Taweel WA 2015).[3]

TYPES OF BLADDERS IN SCI

“In spinal cord injury, bladder dysfunction is generally categorized into three main types: upper motor neuron (UMN) bladder or automatic bladder, lower motor neuron (LMN) bladder or autonomous bladder and mixed type” (Stephen W. Leslie et.al 2023). “Lesions located between the pontine micturition centre and the sacral spinal cord—such as those caused by traumatic spinal cord injury or multiple sclerosis affecting the cervicothoracic region—typically result in an upper motor neuron (UMN) bladder. Damage to the sacral spinal cord that affects the detrusor nucleus while preserving the pudendal nucleus leads to a mixed type A bladder” [5]. Conversely, if the pudendal nucleus is damaged but the detrusor nucleus remains intact, this produces a mixed type B bladder. Injuries directly involving the sacral cord or sacral nerve roots result in a lower motor neuron (LMN) bladder” (Peter T Dorsher 2012).[5]

In suprasacral lesions, which represent upper motor neuron injuries, the bladder typically presents with an overactive detrusor, a hyperreflexic external urethral sphincter, and elevated detrusor pressures exceeding 40 cm H_2O. This often leads to detrusor sphincter dyssynergia (DSD) and results in urinary incontinence.

The bladder dysfunction is more complex in case of mixed, UMN & LMN injury. The external urethral sphincter may be flaccid or hyperreflexic, and the detrusor may still be hyperactive. The patient may have detrusor sphincter areflexia or DSD, and detrusor pressures stay high (over 40 cm H_2O). Urinary incontinence is another complication of bladder dysfunction

Lesions at the sacral level, characteristic of lower motor neuron involvement, produce an areflexic (flaccid) detrusor along with a flaccid external urethral sphincter. As a result, the bladder loses its ability to contract effectively, leading to urinary retention and subsequent overflow incontinence.[8]

COMPLICATIONS OF NEUROGENIC BLADDER

In individuals with spinal cord injury (SCI), neurogenic bladder often leads to secondary complications such as urinary tract infections, stone formation, and impairment of renal function. These complications stem from the altered bladder mechanics itself or from the prolonged use of catheters for urinary drainage.[3]

Urinary tract infections (UTIS)

Individuals with spinal cord injury and managed bladder function often experience recurrent UTIs, which remain a major issue. Symptoms of UTIs may

include fever, unpleasant-smelling urine, and blood in the urine. Research indicates that individuals catheterized by others have a higher risk of febrile UTIs relative to patients performing self-catheterization (CIC) or using indwelling catheters. The lowest incidence of UTIs has been reported in those who have undergone external sphincterotomy. [3]The type of catheter can influence infection rates. One study comparing hydrophilic-coated catheters to uncoated PVC catheters found that the former significantly reduced the incidence of UTIs over one year (64% vs. 82%).[6]

Prophylactic antibiotics have been explored as a preventive measure. A trial using trimethoprim-sulfamethoxazole during the early stages of CIC in recently injured men showed reduced rates of bacteriuria and symptomatic UTIs, but no such effect was observed in women. However, adverse effects and increased antibiotic resistance limit the broader use of this strategy.[6]

Another study found that while antibiotics decreased bacteriuria, they did not significantly reduce symptomatic infections. A larger meta-analysis concluded that routine antibiotic prophylaxis isn't generally effective, as it fails to reduce symptomatic UTIs and contributes to antimicrobial resistance, despite lowering asymptomatic bacteriuria. [6]

Alternative approaches, like weekly oral antibiotics, have shown some promise. One study reported a significant drop in symptomatic UTIs (from 9.4 to 1.8 per patient-year) over two years without increased resistance. [6]

Non-antibiotic options such as methenamine Hippurate and cranberry supplements have not demonstrated clear benefits in preventing UTIs. A novel method involves bladder colonization with a harmless strain of *E. coli* (83972).

Patients who were successfully colonized had no UTIs over a year, compared to those who were not colonized or lost colonization and experienced multiple symptomatic UTIs.[6]

Urethritis and Prostatitis

To minimize urethritis risk, patients are encouraged to use CIC rather than indwelling catheters. Blockages in the periurethral glands can occasionally lead to abscess formation. *E. coli* is the primary cause of prostatitis, and trimethoprim is commonly recommended because it penetrates prostatic tissue effectively.[3]

Bladder Stones

Bladder stones are often due to infections with urea-splitting bacteria, long-term use of indwelling catheters, and high levels of residual urine. Symptoms can include irritation and blood in the urine. Replacing catheters on a weekly basis may reduce stone formation risk.[3]

Vesicoureteral Reflux and Kidney Dysfunction

Over 20% of neurogenic bladder patients develop vesicoureteral reflux, particularly those with suprasacral spinal lesions. Reflux, along with increased detrusor pressure, can lead to renal damage or failure. Treatment aims at lowering detrusor pressure to prevent further kidney harm.[3]

Bladder Cancer

"SCI patients have a 20-fold increased risk of developing bladder cancer compared to the general population. Squamous cell carcinoma is more common than transitional cell carcinoma. Key risk factors include UTIs, bladder stones,

and long-term catheter use. Unfortunately, bladder cancer is often detected at an advanced stage in these patients" (Taweel WA 2015) [3].

INVESTIGATION OF NEUROGENIC BLADDER

The assessment of neurogenic bladder function requires a structured, multidisciplinary approach to accurately diagnose dysfunction, plan treatment, and prevent complications such as renal damage or recurrent infections. [3]Evaluation begins with a thorough history focusing on LUT symptoms—such as incontinence, urgency, frequency, nocturia, dysuria, and recurrent urinary tract infections—as well as past urological conditions, neurological or congenital abnormalities, surgeries, and bowel and sexual function. Documentation of recent bladder-related complications, medication history (including opioids, anticholinergics, and other drugs that influence voiding), allergies, and prior bladder management strategies is essential. [5] A bladder diary maintained over three days, combined with pad testing, can offer critical insights into voiding patterns and incontinence episodes, including those associated with autonomic dysreflexia (AD). [5]

Physical examination should focus on neurological and pelvic assessments, including mental status, muscle strength, reflexes, sacral dermatomes, rectal tone, voluntary anal contraction, and the bulbocavernosus reflex. "The International Standards for Neurological Classification of Spinal Cord Injury (ISNCSCI) and ISAFSCI should be used to determine injury level and completeness, recognizing that even patients with minimal or no motor deficits (AIS E) may experience AD or LUT dysfunction. Factors such as hand function, mobility, cognitive ability, and social support must also be considered when

selecting management strategies like clean intermittent catheterization (CIC)" (Perez, N. E.2022).[8]

Initial investigations include urinalysis, urine culture when indicated, and renal function tests such as serum creatinine, cystatin C, and estimated glomerular filtration rate (eGFR). Due to reduced muscle mass in some patients, more accurate assessments like renal scintigraphy may be necessary. Post-void residual (PVR) measurement using ultrasound or catheterization is vital to assess bladder emptying. Since bladder function can fluctuate, repeated PVR measurements are recommended. Uroflowmetry offers a non-invasive method to evaluate flow patterns and is often performed alongside PVR.[8]

Renal and bladder ultrasounds are key for upper tract monitoring, especially in high-risk individuals. They help detect complications such as hydronephrosis or bladder wall thickening due to poor compliance. Imaging should be performed annually in high-risk and every 1–2 years in moderate-risk patients. In cases of febrile or persistent urinary tract infections (UTIs), upper tract imaging is critical.[12]

UTIs are common in NLUTD and may present atypically with symptoms like muscle spasms or AD rather than fever or dysuria. While symptomatic infections warrant prompt antibiotic treatment, asymptomatic bacteriuria should not be treated to avoid resistance. Preventative strategies like cranberry supplements are ineffective, though bladder instillations and selective antibiotic prophylaxis may be considered in recurrent infections, especially in CIC users.[12]

Invasive urodynamic studies—such as cystometry, pressure-flow studies, and video-urodynamics—are essential for evaluating detrusor activity, bladder

compliance, and outlet resistance. These tests help identify issues like detrusor underactivity, detrusor sphincter dyssynergia (DSD), bladder outlet obstruction, or high-pressure storage that may endanger upper tract integrity. They are particularly important after spinal cord injury and should be performed early, ideally within three months, and repeated as needed if new symptoms emerge. During testing, monitoring for AD is essential, and the study should be halted if AD occurs. Bladder leak point pressure (LPP) over 40 cm H_2O indicates a high risk for renal damage.[12]

Additional diagnostics, including cystoscopy and bladder cytology, are indicated in the presence of haematuria, frequent UTIs, or suspected structural abnormalities like stones or tumours. However, routine use for cancer screening is not supported due to limited sensitivity in detecting early malignancies in patients with long-term catheters. Pelvic floor electromyography (EMG) plays a limited but specific role, particularly in differentiating neurologic syndromes or diagnosing conditions like Fowler's syndrome.

In conclusion, a comprehensive evaluation incorporating clinical, laboratory, imaging, and urodynamic assessments is vital for the optimal management of patients with NLUTD. [12]

In patient with SCI, neurogenic bladder dysfunction is one of the most frequent and serious complications. This condition negatively impacts social participation and psychological wellbeing thereby reducing overall QOL.

Although urodynamic studies are considered the gold standard for evaluation, their availability is often limited due to cost, technical expertise, and

accessibility issues. This creates a gap in the diagnosis and management of neurogenic bladder.

Therefore, there is a need for a reliable assessment tool to facilitate early detection, classification, and management of bladder dysfunction in SCI patients.

AIM AND OBJECTIVES OF THE STUDY

AIM OF THE STUDY

To develop a neurogenic bladder assessment questionnaire in spinal cord injury patients.

OBJECTIVES OF THE STUDY

To categorize the types of neurogenic bladder dysfunction in individuals with SCI, based on the signs and symptoms reported in a specialized Neurogenic Bladder Assessment Questionnaire

REVIEW OF LITERATURE

REVIEW OF LITERATURE

1. **Welk B, Lenherr S. et.al (2018)** conducted a study on "**The Neurogenic Bladder Symptom Score (NBSS): a secondary assessment of its validity, reliability among people with a spinal cord injury".**

The study included a substantial sample of 609 participants, making it one of the more comprehensive validations of this tool in the context of neurogenic bladder. The authors found that the Cronbach's alpha of the total and the incontinence, storage/voiding, and consequences domains was 0.85, 0.93, 0.76, and 0.49 respectively. All item to domain correlations were ≥0.3, aside from 3/7 of the items from the consequences domain and strong test–retest reliability, affirming its robustness as a symptom assessment tool. Additionally, it showed good construct validity, supporting its ability to meaningfully measure symptom severity and impact on quality of life in individuals with SCI. This study highlights the NBSS as a reliable, patient-cantered instrument capable of capturing the nuanced and multifaceted experience of bladder dysfunction in the SCI population. Its application in both clinical and research settings can help guide individualized management strategies and monitor therapeutic outcomes effectively**.**

2. **Welk B. (2024)** conducted a study on **"Questionnaires for Neurogenic Lower Urinary Tract Dysfunction".**

This article discusses how to measure QOL and urinary symptoms in NLUTD

and highlights various questionnaires such as the Qualiveen, Neurogenic Bladder Symptom Score (NBSS), and the Incontinence Quality of Life Questionnaire (I-QOL). These questionnaires focus on bladder-related QOL or symptoms. These tools are important for advancing research and the clinical care of NLUTD patients, and have the potential to impact decision-making and improve patient outcomes.

3. **Welk B, Lenherr S, Elliott S. et.al (2020)** conducted a study on "**The creation and validation of a short form of the Neurogenic Bladder Symptom Score"**

   This study to create a concise and clinically efficient version of the original 24-item Neurogenic Bladder Symptom Score (NBSS), a tool designed to assess bladder-related symptoms in individuals with neurogenic bladder dysfunction. The primary aim was to reduce the burden of lengthy assessments in clinical and research settings while maintaining the tool's validity and reliability. To achieve this, the researchers utilized three previously published datasets and applied a systematic approach to item selection. They identified the most responsive items from each of the NBSS domains—selecting three questions from the incontinence domain, three from the storage/voiding domain, and two from the consequences domain. These eight questions formed the short form version, known as the NBSS-SF. The internal consistency of the NBSS-SF was evaluated using Cronbach's alpha, which yielded a value of 0.76, indicating acceptable reliability. External

validity was established by examining the correlations between the NBSS-SF scores and those from other validated questionnaires, including the Qualiveen-SF, International Consultation on Incontinence Questionnaire (ICIQ), and the American Urological Association Symptom Score (AUASS). The results demonstrated strong alignment with the full NBSS, supporting the construct validity of the short form. Additionally, the test-retest reliability was assessed in a subgroup of 120 patients, showing a high intraclass correlation coefficient (ICC) of 0.84. The study cohort for validation consisted of 230 patients with diverse underlying conditions such as multiple sclerosis (MS), spinal cord injury (SCI), and spina bifida. Notably, the NBSS-SF also exhibited consistent performance in two other independent datasets, further reinforcing its reliability and generalizability across different populations. Despite the success of the short form, the authors acknowledged that the complete NBSS might still be preferable when a more in-depth evaluation of neurogenic bladder symptoms or individual domain scores is required. This study makes a significant contribution to neuro-urological research and practice by offering a brief, yet psychometrically sound, alternative to the original NBSS. The NBSS-SF is particularly valuable in time-sensitive clinical environments or large-scale studies where minimizing patient burden is essential.

4. **Welk B, Morrow SA. et.al (2013)** conducted a study on "**The conceptualization and development of a patient-reported neurogenic bladder symptom score"**

To address the lack of a dedicated patient-reported tool for evaluating symptoms and bladder-related impacts specific to neurogenic bladder dysfunction, a study was undertaken to develop a novel symptom assessment instrument. The item pool was generated through a comprehensive literature review of 37 existing instruments (8 neurogenic QoL and 29 urinary symptom-specific tools), along with semi structured interviews conducted with 16 adults diagnosed with spinal cord injury, multiple sclerosis, or spina bifida. Commonly reported issues included urinary incontinence, UTIs, urgency, and bladder spasms. A total of 266 relevant items were extracted, which were then narrowed down through expert review and rated based on clinical relevance. The resulting 25-item draft questionnaire demonstrated high mean importance scores (3.1–4.3) and consistency across domains. This preliminary work laid the foundation for a standardized, patient-centred tool tailored to neurogenic bladder symptoms, with future validation and psychometric testing in progress.

5. **Piault E, Evans CJ.et.al (2008)** conducted a study on "**Development and validation of the Overactive Bladder Satisfaction (OAB-S) Questionnaire".**

   The Overactive Bladder Satisfaction Questionnaire (OAB-S) was developed to assess patient satisfaction with OAB treatment. Its development involved a literature review, conceptual model formation, and interviews with both US-English and US-Spanish speaking patients.

The tool's translatability into other languages was also evaluated. Psychometric validation was conducted through a longitudinal, non-randomized study with 201 OAB patients. The OAB-S includes five multi-item scales—OAB Control Expectations, Impact on Daily Living, OAB Control, Medication Tolerability, and Satisfaction with Control—along with five single-item global assessments. The questionnaire showed strong internal consistency (0.76–0.94) and test-retest reliability (0.72–0.87). All scales, except for medication tolerability, effectively differentiated between patients based on OAB severity and incontinence status. Overall, the OAB-S is a reliable and valid instrument for measuring patient satisfaction with OAB treatment and is suitable for both clinical and research use.

6. **Burks J, Chancellor M. et.al (2013)** conducted a study on "**Development and validation of the actionable bladder symptom screening tool for multiple sclerosis patients"**

   This study aimed to develop and validate a screening tool specifically designed to identify bladder symptoms in individuals with multiple sclerosis (MS), a population in which such symptoms—like urinary urgency, frequency, and incontinence—are common but frequently overlooked in clinical care. These issues are often caused by neurogenic detrusor overactivity (NDO) and can significantly disrupt daily functioning and quality of life. To address this unmet clinical need, the researchers created the Actionable Bladder Symptom Screening Tool (ABSST) through a structured process that included a thorough

literature review, content validation by experts, and a multisite observational study. The ABSST was rigorously tested for psychometric reliability and validity. The tool demonstrated excellent internal consistency, with a Cronbach's alpha of 0.95 for the total score and values ranging from 0.85 to 0.90 across its three domains. Its validity was confirmed through strong correlations with established measures such as the Overactive Bladder Questionnaire Short Form (OAB-q SF), particularly in terms of symptom severity and health-related quality of life, with Spearman correlation coefficients exceeding 0.78. Furthermore, the ABSST showed strong predictive validity in identifying patients who may require referral to a urologist. Developed with input from both clinicians and MS patients, the tool meets the content validity and psychometric standards recommended by the U.S. Food and Drug Administration. Overall, it offers a reliable, sensitive, and specific method for improving the detection and management of bladder dysfunction in the MS population.

7. **Bryce TN, Tsai CY et.al (2025)** conducted a study on "**Development and Testing of the Spinal Cord Injury Bladder and Bowel Control Questionnaire (SCI-BBC-Q)".**

   This study aimed to develop a validated patient-reported outcome (PRO) tool to assess motor and sensory components of lower urinary tract (LUT) and lower gastrointestinal tract (LGIT) function in individuals with spinal cord injury (SCI). The resulting instrument, the Spinal Cord Injury Bladder and Bowel Control Questionnaire (SCI-BBC-Q)**,** was

designed to address the lack of standardized tools for monitoring recovery and treatment outcomes in neurogenic dysfunction. The development process involved a literature review, conceptual framework creation, item generation, expert feedback, and cognitive interviews. The final questionnaire includes six items and takes about five minutes to complete. Psychometric evaluation demonstrated its clarity, feasibility, internal consistency, reliability, and significant correlations with established clinical measures. The SCI-BBC-Q provides a practical and reliable method for tracking LUT and LGIT function, particularly useful during the acute and subacute phases of SCI recovery and for monitoring treatment responses.

8. **Bonniaud V, Bryant D. et.al (2008)** conducted a study on **Development and Validation of the Short Form of a Urinary Quality of Life Questionnaire: SF-Qualiveen.**

   This study aims to evaluate a shorter version of the Qualiveen questionnaire—SF-Qualiveen**,** an 8-item self-administered tool—developed to assess urinary disorder-related health-related quality of life (HRQoL) in patients with neurological conditions such as Multiple Sclerosis (MS) and Spinal Cord Injury (SCI**)**. The original 30-item Qualiveen has been well-established in the literature for its validity, reliability, and responsiveness. However, its length can be a limitation in large clinical trials or long-term follow-up studies, where time efficiency and participant compliance are critical. To address these practical challenges, a multicentre study was conducted involving 180

English- and French-speaking MS patients from Canada and France. Participants completed the full Qualiveen, the MSQOL-54 (or its French version SEP-59), and urinary function assessments at two time points, spaced between 2 to 10 weeks. At the second visit, patients also provided global ratings of change in urinary HRQoL. These data were used to construct and validate the SF-Qualiveen. The short form demonstrated high correlation with the original questionnaire **(**r = 0.70 to 0.92**),** indicating strong concurrent validity. It also showed excellent test-retest reliability **(**ICC = 0.83 to 0.93**)** and a level of responsiveness (standardized response mean, SRM = 0.75 to 1.62**)** comparable to the full version. Construct validity was supported by cross-sectional and longitudinal correlations **(**weighted $\kappa = 0.55$ and 0.66, respectively) with established instruments and change scores. These findings suggest that SF-Qualiveen retains the psychometric strengths of the original long-form questionnaire while offering a more practical and time-efficient alternative. Its strong measurement properties make it well-suited for both clinical application and research involving patients with neurogenic bladder dysfunction.

METHODOLOGY AND PROCEDURE

METHODOLOGY

- **STUDY DESIGN:** CROSS-SECTIONAL STUDY
- **STUDY TYPE:** QUALITATIVE
- **STUDY POPULATION:** SPINAL CORD INJURY
- **SAMPLE SIZE:** 30
- **SAMPLING TECHNIQUE:** PURPOSIVE SAMPLING
- **STUDY SETTING:** IMS, SUM HOSPITAL & RSIC, CUTTACK
- **STUDY DURATION:** 1 year
    - **Ethical clearance:**6 months
    - **Sample selection, data collection:** 2 months
    - **Statistical analysis, results analysis, discussion:** 4 months
- **MATERIAL REQUIRED:** pencil, paper (ASIA screening tool, questionnaire) cotton, pin, Gloves
- **INCLUSION CRITERIA:**
    - Diagnosed SCI with bladder dysfunction
    - Both genders, age above 18
    - Both traumatic and non-traumatic SCI

- **EXCLUSION CRITERIA:**

- SCI patient having any other neurological condition.

- ASIA scale –A

QUESTIONNAIRE DEVELOPMENT PROCEDURE

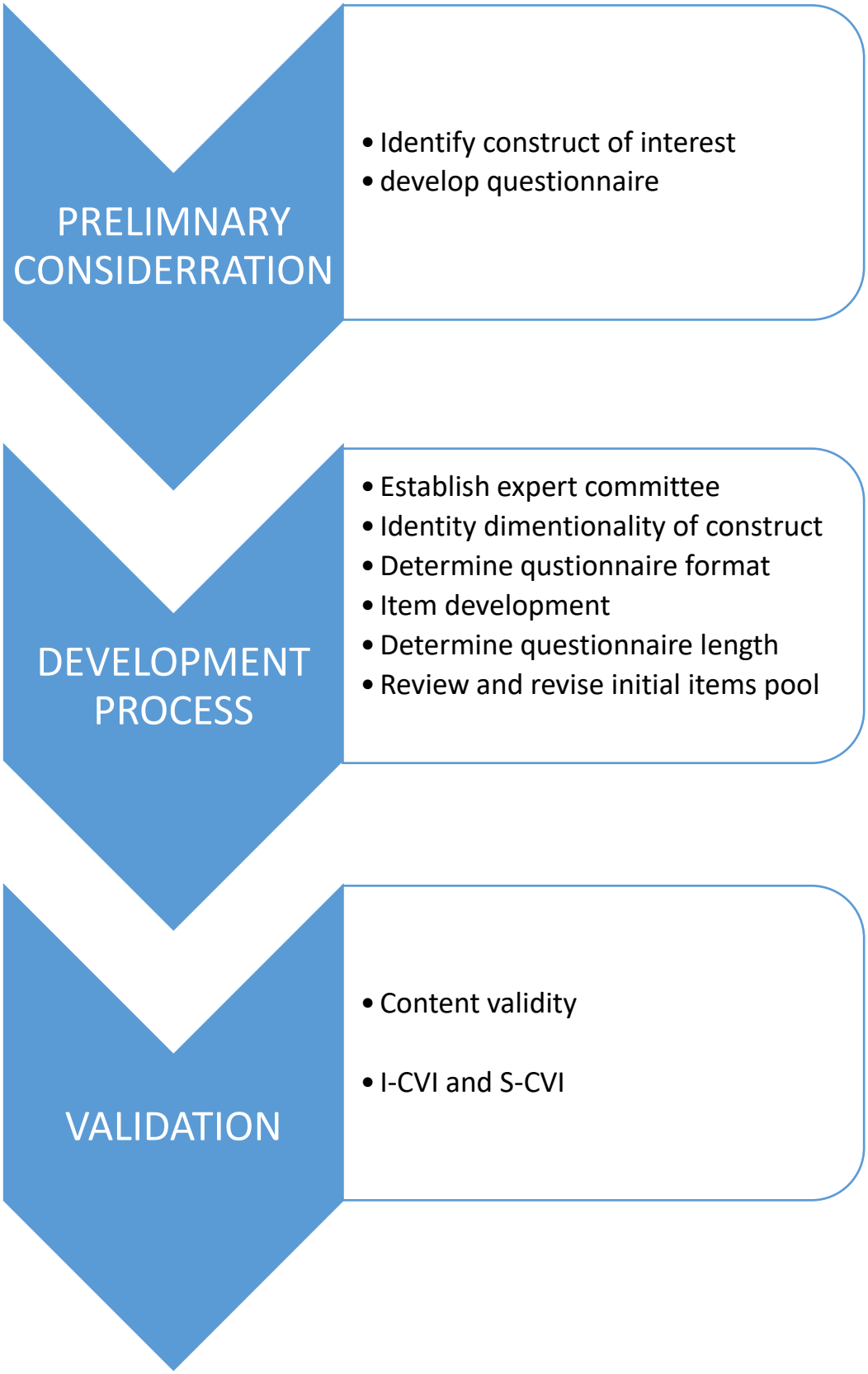


Figure -1

Step 1: Literature Review

The initial step in the development of the Neurogenic Bladder Assessment Questionnaire involved conducting a comprehensive literature review to identify existing tools or standardized instruments for assessing neurogenic bladder symptoms specifically in SCI Patients. The search was conducted using reputable databases including PubMed, Scopus, and Google Scholar, and was limited to articles published in the English language over the past 10 years.

A systematic search strategy was employed using combinations of keywords such as:

("Neurogenic bladder" OR "bladder dysfunction") AND ("questionnaire" OR "assessment tool" OR "instrument") AND ("spinal cord injury" OR "SCI").

Despite an extensive search, the review did not yield any comprehensive or condition-specific questionnaire that was both psychometrically validated and tailored specifically to the needs and symptom profiles of SCI patients. The available tools were not specific to evaluate the type of neurogenic bladder in SCI.

This limitation in the existing literature emphasized the necessity for a condition-specific assessment tool, which justified creating a new questionnaire tailored to classify bladder types in this population.

Step 2: Determining and Conducting Questionnaire Administration

Individuals with SCI were asked questions directly to administer the

Neurogenic Bladder Assessment Questionnaire. This method was selected to ensure a thorough understanding of the questions being asked and to allow participants who might have hand function or literacy problems.

In order to preserve consistency and reduce interviewer bias, the questions were asked to hospital patients in accordance with a set protocol. In addition to ensuring that responses were thorough and precise, the face-to-face format helped participants to ask questions when necessary. Additionally, this method encouraged open discussion about symptoms related to sensitive bladders and helped to establish a relationship.

Step 3: Determining the Question Format

A closed-ended question format has been selected for the Neurogenic Bladder Assessment Questionnaire (NBAQ), which was developed for patients with SCI, with the aim to provide response consistency, clarity, and simple administration. Three fixed response options were included in each item's structure: Yes, Maybe, and No. In addition to providing a neutral or ambiguous option, this trichotomous format was chosen to allow participants to clearly express affirmative or negative responses. Each response was assigned a numerical score for quantitative evaluation:

- Yes = 2
- Maybe = 1
- No = 0

The use of this fixed scoring system supports straightforward data analysis

and enables classification of bladder type based on cumulative scores within specific symptom categories (Autonomous/LMN, Automatic/UMN, or Mixed type). This standardized tool ensures that participants with various levels of intellectual or motor impairment can still give accurate answers and are especially appropriate for face-to-face interviews.

Step-4: Phase -1 Item development

The first set of questions for the *Neurogenic Bladder Assessment Questionnaire* was created after a thorough literature review and consideration of clinical features commonly observed in SCI patients. Domains such as urinary frequency, urgency, incontinence, retention, bladder sensation, spastic bladder, bladder spasms, and flaccid bladder were identified as essential constructs. Within each domain, draft questions were framed in clear, direct language to make them easily understandable to patients during face-to-face administration. The first draft of the questionnaire consisted of items grouped under nine domains, designed to capture the range of neurogenic bladder symptoms. The initial draft comprised a wide pool of items (over 18 questions), formulated in simple and patient-friendly language to ensure clarity and ease of response. Items were designed as close-ended questions. (Refer to appendix-3)

Step 5: 1st round Expert opinion

A multidisciplinary expert working group consisting of a Urologist (with specialization in neurogenic bladder dysfunction), a Neurologist, and four Neuro-physiotherapist (with specialization in SCI), was assembled. The initial draft of the **Neurogenic Bladder Assessment Questionnaire** was submitted

to the expert's panel. The aim of this review was to evaluate the relevance, clarity, and clinical applicability of the items and to provide constructive feedback for refinement.

After reviewing the questionnaire, the experts acknowledged the comprehensive coverage of bladder dysfunction domains but identified several concerns that required modification:

- **Item Redundancy:** Some items overlapped in content, particularly in the domains of urgency and spastic bladder, leading to repetition. Experts recommended merging or rephrasing such items to avoid redundancy.

- **Ambiguity:** Certain terms were found to be vague or open to multiple interpretations. For instance, questions around "unusual sensations" required clearer wording to prevent inconsistent patient responses.

- **Double-Barrelled Questions:** A few items combined more than one symptom in a single question (e.g., bladder contraction and leakage), which could confuse respondents and affect the reliability of responses.

- **Irrelevance for Patient-Reported Outcomes**: Some items used technical terminology (e.g., "detrusor hyperreflexia," "areflexic bladder"), which might not be meaningful to patients. Experts advised replacing these with patient-centred descriptions that reflect observable or felt symptoms.

- **Length:** The initial draft was considered somewhat lengthy, with overlapping domains contributing to respondent burden. The panel recommended condensing the questionnaire to focus on the most clinically significant and relevant items.

- **Scoring Inconsistencies** – The initial draft did not specify a clear scoring system for all items. The experts suggested adopting a standardized response pattern (e.g., Yes/Maybe/No with scoring 2/1/0) to maintain uniformity and facilitate quantitative analysis.

Step 6: phase- 2 Item Development

Based on the feedback obtained from the expert panel review of the initial questionnaire, several modifications were made to improve the clarity, clinical relevance, and patient comprehensibility of the items.

Accordingly, the following changes were implemented in the second phase of item development:

Symptom Cluster Organization – Items were grouped under clinically meaningful categories to reflect different bladder dysfunction patterns:

- Uninhibited bladder or cortical bladder
- Autonomous/LMN type bladder
- Automatic/UMN type bladder
- Sensory paralytic bladder
- Motor paralytic bladder

Balanced Item Distribution – Each bladder type was represented by 5–6 **items**, ensuring comprehensive coverage without overwhelming the patient with excessive questions. (Refer to appendix-4)

Step 7 :2nd round Expert Opinion

The questionnaire consisting of 18 items was considered appropriate in length and relevant for the target population. However, the experts recommended that the items should be categorized into three specific domains: Upper Motor Neuron (UMN/Automatic type), Lower Motor Neuron (LMN/Autonomous type), and Mixed type of bladder dysfunction. It was emphasized that the previously included categories of *motor paralytic bladder* and *sensory paralytic bladder* are less applicable in the context of spinal cord injury, as these conditions are more commonly observed in other neurological disorders.

Each item was further evaluated based on its clarity, redundancy, and clinical applicability. Questions with overlapping content were noted for possible refinement, while ambiguous wording was advised to be simplified to enhance patient comprehension. Overall, the experts agreed that restructuring the questionnaire into the three recommended domains would improve its specificity, face validity, and ease of administration in the SCI population.

Step 8: phase- 3 Item Development

Based on expert suggestions, the questionnaire was revised, refined, and the total number of items remained unchanged at 18, grouped into three categories of bladder dysfunction (LMN, UMN, and Mixed types). The item development process was guided by clinical symptomatology and categorized

into three main domains corresponding to the types of neurogenic bladder:

1. Autonomous/LMN type bladder – reflecting weak or absent detrusor contractions, incomplete emptying, and slow or small urinary flow.
2. Automatic/UMN type bladder – reflecting detrusor hyperreflexia with urgency, frequency, pain, and urge incontinence.
3. Mixed type bladder – reflecting overlapping symptoms of both LMN and UMN patterns.

A total of 18 items were generated, with 6 items for each bladder type, ensuring balanced representation of symptom clusters. Each item was written in clear, simple, and patient-friendly language to avoid ambiguity and to be easily understood during face-to-face interviews.

To ensure response uniformity, all items were formatted as close-ended questions with three options: Yes, Maybe, and No, which were scored as 2, 1, and 0 respectively. This scoring system allows quantification of symptom severity and helps in classifying the type of neurogenic bladder.

During the drafting phase, items were reviewed for:

- Clarity (avoiding complex medical terms),
- Relevance (covering core symptoms of bladder dysfunction),
- Singularity (each question addressing one symptom at a time),
- Consistency (similar structure and phrasing across all domains).

This process resulted in an 18-item preliminary questionnaire, designed to

differentiate LMN, UMN, and mixed bladder types in SCI patients (Refer to appendix -5).

Step 9: Preliminary pilot testing

A preliminary version of the Neurogenic Bladder Assessment Questionnaire was tested on a small sample of 30 spinal cord injury (SCI) patients. The purpose of this stage was to evaluate the feasibility, clarity, and acceptability of the questionnaire items, as well as to detect any potential floor or ceiling effects in the response distribution.

The pilot administration was carried out through face-to-face interviews in a clinical setting. Participants were asked to provide response on the items' relevance to their bladder symptoms, simple understanding, and question clarity. Result of the pilot testing showing, most participants were unable to understand and respond to the items. Among patients with catheterization, a significant limitation was found.

These patients reported difficulty in answering several items, particularly those related to bladder sensation, urgency, and frequency, due to the absence of normal bladder sensations when using catheters. As a result, they were unable to provide meaningful responses to key domains of the questionnaire.

Step-10: Revise and finalize the questionnaire

Following the results of the preliminary pilot testing and subsequent expert panel discussions, necessary revisions were made to refine the questionnaire. The major issue identified was that catheterized patients (indwelling or intermittent) were unable to respond meaningfully to items related to bladder

sensation, urgency, and frequency due to the absence of voluntary bladder control. This significantly limited the applicability of the tool to this subgroup.

After careful deliberation, it was jointly decided by the researcher and the expert panel to restrict the scope of the questionnaire to non-catheterized spinal cord injury (SCI) patients who retain at least partial bladder sensation and voluntary voiding function. This refinement ensured that the items remained clinically relevant, interpretable, and patient-centred.

Accordingly, the final version of the tool was titled: "Neurogenic Bladder Assessment Questionnaire in Spinal Cord Injury (Without Catheterisation)."

The final questionnaire retained 18 items, grouped into three domains representing Autonomous/LMN bladder, Automatic/UMN bladder, and Mixed bladder types. All items were structured as close-ended questions with standardized response options (Yes = 2, Maybe = 1, No = 0), ensuring uniform scoring and facilitating diagnosis/classification based on symptom clusters. (Refer appendix -6)

Step-11: Expert Review

The finalized draft of the Neurogenic Bladder Assessment Questionnaire in Spinal Cord Injury (Without Catheterisation) was submitted to a panel of experts (urologists, neurologists, and physiotherapists) for content validation. The experts were asked to independently evaluate each item for its relevance, clarity, simplicity, and necessity in relation to the construct being measured.

A 4-point relevance scale was used for this evaluation: 1 = Not relevant 2 = Somewhat relevant / needs major revision

3 = Quite relevant but needs minor revision
4 = Highly relevant.

Based on these ratings, the Item Content Validity Index (I-CVI) was calculated as the proportion of experts rating an item as either 3 or 4. The average of the I-CVIs for each item was then applied to determine the Scale Content Validity Index (S-CVI). This method ensured that every item was both clinically relevant and accessible to the target population, and it provided a statistical measure of the questionnaire's content validity.

STATISTICAL ANALYSIS

STATISTICAL ANALYSIS

The Item Content Validity Index (I-CVI) and the Scale Content Validity Index (S-CVI) were used to determine the Neurogenic Bladder Assessment Questionnaire's content validity.

For I-CVI, each item was rated by the panel of experts on a 4-point relevance scale (1 = not relevant, 2 = somewhat relevant, 3 = quite relevant, 4 = highly relevant). The I-CVI for each item was calculated as the proportion of experts rating the item as either 3 or 4.

I-CVI = (Number of experts rating the item as 3 or 4) / (Total number of experts)

For S-CVI, two Methods were applied:

Method 1: S-CVI/Ave (Average Method)

S-CVI/Ave = (Sum of all I-CVI values) / (Total number of items)

Method 2: S-CVI/UA (universal agreement)

S-CVI/UA = (Number of items with I-CVI = 1.0) / (Total number of items)

Interpretation

- I-CVI: ≥ 0.78 is considered acceptable when you have ≥ 6 experts. (Lynn, 1986; Polit & Beck, 2006).
- S-CVI/Ave: ≥ 0.90 is excellent.
- S-CVI/UA: ≥ 0.80 is desirable

RESULTS

RESULTS

A total of 18 items on the Neurogenic Bladder Assessment Questionnaire in Spinal Cord Injury (Without Catheterization). A panel of experts (n = 6) evaluated each item on a 4-point relevance scale to determine its content validity.

- The I-CVI for individual items ranged from 0.83 to 1.0, indicating that all items met the minimum acceptable cutoff of ≥ 0.78, as recommended by Lynn (1986) and Polit & Beck (2006).
- The S-CVI/Ave was calculated as 0.97, which is considered excellent since values ≥ 0.90 indicate strong overall content validity of the scale.
- The S-CVI/UA was 0.83, which surpasses the desirable threshold of ≥ 0.80, confirming universal agreement among experts for the majority of items.

These findings demonstrate that the final 18-item questionnaire has strong content validity and is suitable for use in non-catheterized spinal cord injury patients.

The high I-CVI values indicate that each item was judged to be relevant by the majority of experts, while the excellent S-CVI/Ave reflects strong agreement across the entire scale. The acceptable S-CVI/UA further confirms consistency among expert reviewers. Collectively, these results suggest that the questionnaire items are clinically meaningful, clearly worded, and appropriate for the intended population.

Table -1: score of each Item by the expert panel

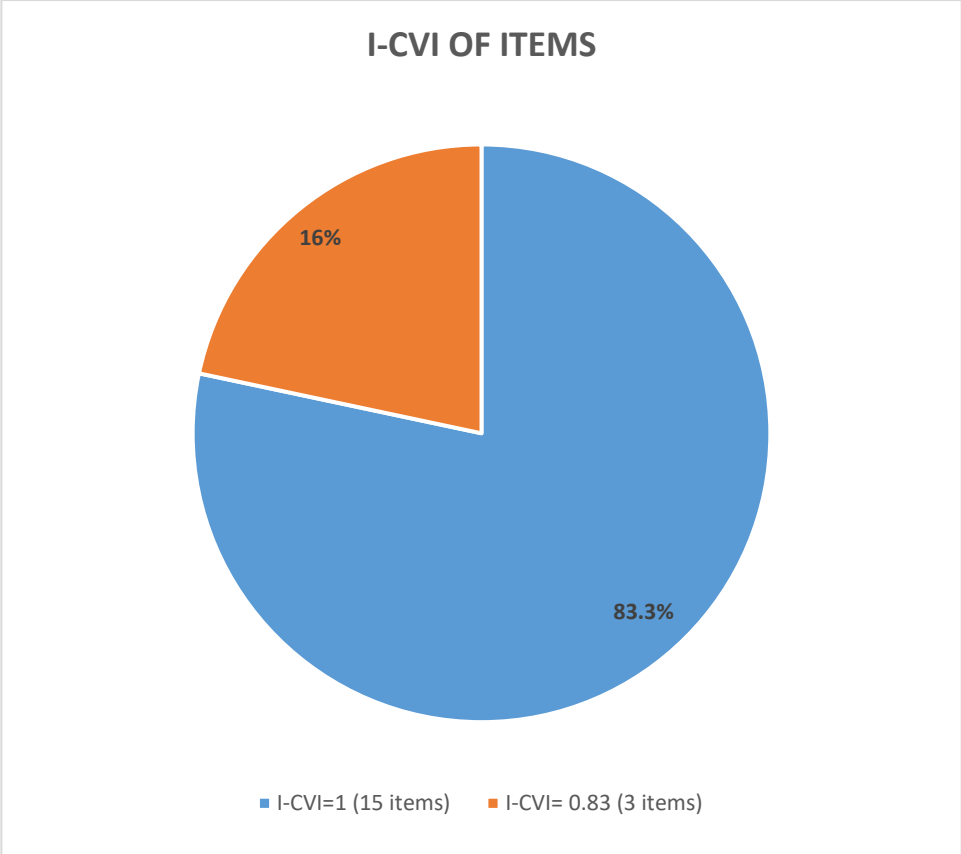
ITEM NO.	NEUROLOGIST	UROLOGIST	NEURO-PHYSIOTHERAPIST-1	NEURO-PHYSIOTHERAPIST-2	NEURO-PHYSIOTHERAPIST-3	NEURO-PHYSIOTHERAPIST-4
1	1	3	3	3	3	4
2	4	4	3	3	3	3
3	4	4	4	4	4	4
4	2	4	4	4	3	3
5	3	3	3	4	3	3
6	3	3	3	4	4	4
7	4	4	4	4	4	4
8	4	4	4	4	3	3
9	3	3	3	3	3	3
10	3	4	3	4	4	3
11	4	4	4	4	3	4
12	4	4	4	4	4	4
13	1	3	3	3	3	3
14	4	4	4	4	4	3
15	3	3	3	3	3	3
16	3	3	3	3	3	3
17	4	4	4	3	3	3
18	4	4	4	3	3	4

Table-2: I-CVI of each Item

ITEM NUMBER	I-CVI
1	0.83
2	1
3	1
4	0.83
5	1
6	1
7	1
8	1
9	1
10	1
11	1
12	1
13	0.83
14	1
15	1
16	1
17	1
18	1

Table -3: S-CVI

S-CVI/Ave (Average Method)	0.97
S-CVI/UA (universal agreement)	**0.83**



Graph-1

The chart shows that 15 items had an I-CVI of 1, while 3 items had an I-CVI of 0.83.

DISCUSSION

DISCUSSION

"Neurogenic bladder dysfunction is a common sequela of spinal cord injury (SCI), with reported prevalence ranging from 70–84% depending on the level and severity of injury, and is a major contributor to morbidity due to urinary tract infections, renal impairment, and reduced quality of life" (Miller CA 2021). Accurate assessment and classification of bladder dysfunction are therefore crucial for guiding management strategies and preventing secondary complications. Although several urinary symptom questionnaires exist, most are designed for the general population or for neurological disorders like MS, and only a limited number are tailored specifically for SCI patients .[28]Furthermore, there is currently no systematically designed instrument for non-catheterized SCI population, a subgroup where symptom-based reporting remains essential. The present study aimed to fill that gap by creating and validating the *Neurogenic Bladder Assessment Questionnaire in SCI (Without Catheterisation)*. The novelty of this tool lies in its structured, symptom-based approach to classifying bladder dysfunction into UMN, LMN, or mixed types. Following a systematic process of literature review, expert consultation, and pilot testing, a final 18-item version was produced. The content validation process demonstrated excellent results, with I-CVI values ranging from 0.83 to 1.0, an S-CVI/Ave of 0.97, and an S-CVI/UA of 0.83, confirming strong content validity and the suitability of the questionnaire for clinical and research use.

The findings of this study are consistent with earlier works on Questionnaire development and validation in healthcare. According to Lynn (1986), an I-

CVI of ≥0.78 is the minimum acceptable threshold when at least six experts are involved in item rating. Polit and Beck (2006, 2007) further reinforced this standard, recommending S-CVI/Ave ≥0.90 as the benchmark for excellent content validity at the scale level. All of the items in the current study met these criteria, and many of them had expert agreement. This shows how the tool fulfils the criteria for accuracy of methodology in psychometric studies.

In a face-to-face clinical interview, patients with SCI can effectively respond to the questionnaire, which consists of 18 clinical questions. Key symptoms such as urgency, frequency, difficulty emptying the bladder, leakage, or a weak stream are the focus of these questions. Clinicians can determine through analysing the responses

whether the bladder shows symptoms of a LMN type, UMN type, or a mixed type. This classification is essential because it helps healthcare professionals in determining the most effective bladder care treatment for each patient. Thus, a person with an overactive bladder may require therapy or medication to reduce urgency and leakage, while someone with an underactive bladder may require techniques to help emptying. In short, providing an understanding of the type of bladder problems currently present, this tool can simplify the work of both the patient and the doctor, decrease ambiguity and increase treatment accuracy. Furthermore, by engaging patients in reporting their symptoms, the tool promotes better awareness of their condition, which may enhance participation in care and adherence to treatment.

Although the study provides a promising new tool, several limitations must be

acknowledged. The most important limitation is that the questionnaire was designed and validated only in non-catheterized SCI patients. Since many individuals with SCI depend on indwelling or intermittent catheterization, the questionnaire cannot yet be generalized to this larger subgroup. Catheterized patients were unable to answer several items that require bladder sensation, frequency, or urge perception, which represents a significant gap. Another limitation relates to the sample size—the pilot study involved only 30 participants, which, while sufficient for preliminary testing, is not large enough to represent the heterogeneity of the SCI population. Further studies with large sample are necessary to confirm the reliability and validity of the tool. Finally, the questionnaire was not validated against urodynamic testing, which is considered the gold standard for diagnosing neurogenic bladder dysfunction. Without such objective correlation, the tool should be considered a screening and classification aid, rather than a definitive diagnostic substitute. These limitations highlight the need for further refinement and validation before the tool can be widely recommended in all clinical settings.

Based on the strengths of this study, several future research directions can be suggested. First, the questionnaire needs to be tested in a large population to conform its generalizability. Second, future study should focus the development of questionnaire for individual with catheterized. Third, future studies should aim to compare the questionnaire with urodynamic studies, thereby improving its accurate diagnose. Psychometric analyses for reliability, including internal consistency, test-retest consistency, and responsiveness to clinical change, should also be performed on the tool. Its universal applicability can be further increased by cross-cultural adaptation and

translation into other languages. Furthermore, longitudinal research needs to focus into how it helps monitor outcomes of treatment over time, allowing healthcare workers to assess whether bladder function has improved or deteriorated as rehabilitation goes on. Future studies can improve bladder management, patient education, and quality of life in SCI rehabilitation worldwide by addressing these issues and developing this questionnaire into a strong, universally applicable tool.

CONCLUSION

CONCLUSION

The study represents an initial effort to create a dedicated questionnaire for evaluating neurogenic bladder dysfunction among non-catheterized SCI population. Based on expert opinion and pilot testing, the questionnaire was refined into a clear and concise 18-item tool that represent the key symptoms of bladder dysfunction. The strong content validity scores further highlight its suitability and practical value for this patient group.

The study represents a clear, standard way for doctors or therapists to assess bladder problems. This questionnaire is patient-centred, easy to use, and valuable for both clinical practice and research.

More research is needed to see if this approach works for patients with catheters and how it compares with objective tests like urodynamics. However, the study provided a framework for identify the type of bladder in SCI. By turning this subjective questionnaire to objective tool will allow more concise classification, more Individualised treatment, and improved outcomes for patients.

LIMITATION

LIMITATION

The current study has certain limitations. Initial, the tool was developed and validated only for non-catheterized SCI patients, which restricts its applicability to those using indwelling or intermittent catheterization. Second, the sample size was small, because only 30 participants were included in this pilot study. Finally, the questionnaire was not compared with urodynamic studies, the gold standard for assessing bladder dysfunction, which limits its diagnostic validity.

Though there are some limitations, the current study is an essential initial step in creating a standard, patient-reported questionnaire designed especially to evaluate neurogenic bladder in SCI patients who are not catheterization-dependent. The tool provides an effective and clinically relevant approach that can help with the identification and classification of bladder dysfunction.

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RECOMMENDATION FOR FUTURE STUDY

RECOMMENDATION FOR FUTURE STUDY

This study gives structured questionnaire to evaluate neurogenic bladder in non-catheterized SCI papulation; however, further researches are needed to enhance its clinical value. Future studies should focus:

1. To assess the reliability and validity of the questionnaire
2. **Cross-Cultural Adaptation** – Translate and validate the questionnaire in different languages and sociocultural contexts to expand its global applicability.
3. **Integration into Clinical Pathways** – Explore the use of the questionnaire as part of routine rehabilitation protocols, both as a screening tool and as an outcome measure to monitor treatment effectiveness.

SUMMARY

SUMMARY

The Neurogenic Bladder Assessment Questionnaire (NBAQ) was developed and validated in the present study for patient with non-catheterized SCI. The 18-item tool uses a simple Yes/Maybe/No format to classify bladder dysfunction into UMN, LMN, or Mixed types. Excellent content validity was shown by validation (I-CVI 0.83–1.0; S-CVI/Ave 0.97; S-CVI/UA 0.83). The NBAQ is helpful in diagnosis, individualized therapy, and preventing risks. It is non-invasive, cost-effective and beneficial. The small sample size, absence of urodynamic correlation, and exclusion of individuals who were catheterized are the limitations. It provides a foundation for further evaluation and validation.

STATEMENT OF FUNDING

STATEMENT OF FUNDING

No outside funding was reported associated with the work featured in this thesis.

BIBLIOGRAPHY

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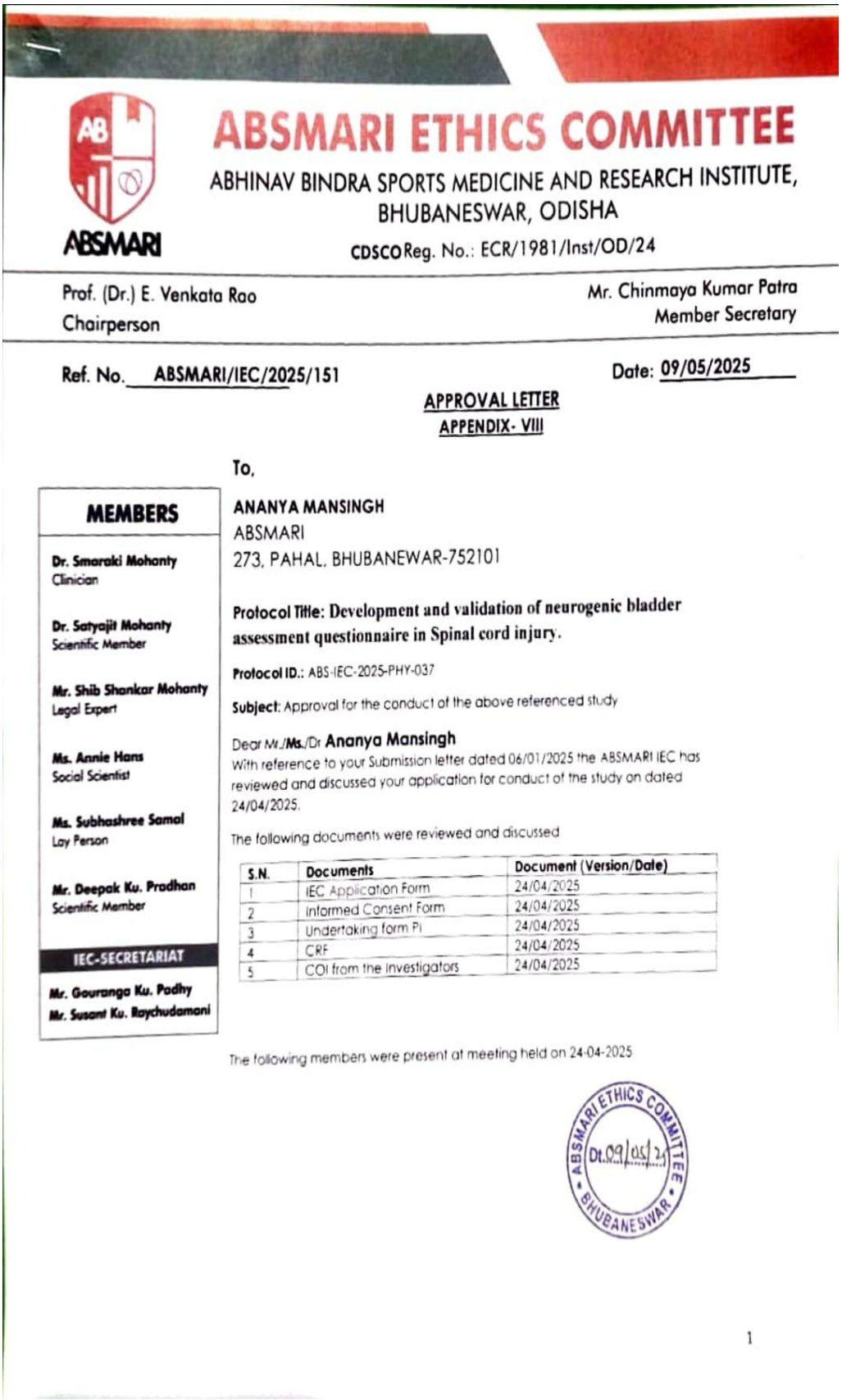
ANNEXURES

ANNEXURE-1 ETHICAL APPRROVAL LETTER



ABSMARI ETHICS COMMITTEE

ABHINAV BINDRA SPORTS MEDICINE AND RESEARCH INSTITUTE, BHUBANESWAR, ODISHA

CDSCO Reg. No.: ECR/1981/Inst/OD/24

Prof. (Dr.) E. Venkata Rao
Chairperson

Mr. Chinmaya Kumar Patra
Member Secretary

Ref. No. ABSMARI/IEC/2025/151

Date: 09/05/2025

APPROVAL LETTER
APPENDIX- VIII

To,

ANANYA MANSINGH
ABSMARI
273, PAHAL, BHUBANEWAR-752101

Protocol Title: Development and validation of neurogenic bladder assessment questionnaire in Spinal cord injury.

Protocol ID.: ABS-IEC-2025-PHY-037

Subject: Approval for the conduct of the above referenced study

Dear Mr./**Ms.**/Dr **Ananya Mansingh**
With reference to your Submission letter dated 06/01/2025 the ABSMARI IEC has reviewed and discussed your application for conduct of the study on dated 24/04/2025.

The following documents were reviewed and discussed

S.N.	Documents	Document (Version/Date)
1	IEC Application Form	24/04/2025
2	Informed Consent Form	24/04/2025
3	Undertaking form PI	24/04/2025
4	CRF	24/04/2025
5	COI from the investigators	24/04/2025

The following members were present at meeting held on 24-04-2025

MEMBERS

Dr. Smaraki Mohanty
Clinician

Dr. Satyajit Mohanty
Scientific Member

Mr. Shib Shankar Mohanty
Legal Expert

Ms. Annie Hans
Social Scientist

Ms. Subhashree Samal
Lay Person

Mr. Deepak Ku. Pradhan
Scientific Member

IEC-SECRETARIAT

Mr. Gouranga Ku. Padhy
Mr. Susant Ku. Raychudamani

ABSMARI ETHICS COMMITTEE * BHUBANESWAR * Dt. 09/05/25

1

ABSMARI ETHICS COMMITTEE

ABHINAV BINDRA SPORTS MEDICINE AND RESEARCH INSTITUTE, BHUBANESWAR, ODISHA

CDSCO Reg. No.: ECR/1981/Inst/OD/24

Prof. (Dr.) E. Venkata Rao
Chairperson

Mr. Chinmaya Kumar Patra
Member Secretary

Ref. No. ABSMARI/IEC/2025/151

Date: 09/05/2025

MEMBERS

Dr. Smaraki Mohanty
Clinician

Dr. Satyajit Mohanty
Scientific Member

Mr. Shib Shankar Mohanty
Legal Expert

Ms. Annie Hans
Social Scientist

Ms. Subhashree Samal
Lay Person

Mr. Deepak Ku. Pradhan
Scientific Member

IEC-SECRETARIAT

Mr. Gouranga Ku. Padhy
Mr. Susant Ku. Raychudamani

S.N.	Name of the Member	Designation & Qualification	Representation as per NDCT 2019	Gender (M/F)	Affiliation with the Institution (Y/N)
1	Prof. Dr. E. Venkata Rao	Professor (MBBS, MD, Dept. of Community Med.) IMS & Sum Hospital, BBSR	Chair Person	M	N
2	Dr. Smaraki Mohanty	Asst. Prof-IMS & Sum Hospital/MBBS, MD (Community Med)	Clinician	F	N
3	Mr. Chinmaya Kumar Patra	Principal-ABSMARI, MPT	Member Secretary	M	Y
4	Ms. Annie Hans	Disability Inclusive Development Co-Ordinator in Humanity and Inclusion (India/Nepal/Srilanka), /MA in Social Work	Social Scientist	F	N
5	Ms. Subhashree Samal	Ret. Reader-Pol Sc.	Lay Person	F	N
6	Mr. Deepak Kumar Pradhan	Asst. Prof-ABSMARI, MPT	Scientific Member	M	Y

This is to confirm that only members who are independent of the Investigator and the Sponsor of the trial have voted/ provided opinion on the trial.

This Committee approves the documents and the conduct for the study in the presented form with necessary recommendation.

The ABSMARI IEC must be informed about the progress of the study in the prescribed format attached, any SAE occurring in the course of the study, any changes in the protocol and patient information/informed consent/assent and request to provide a copy of the final report.

The ABSMARI IEC follows procedures that are in compliance with the requirements of ICH (International Conference on Harmonization) guidance related to GCP (Good Clinical Practice) and applicable Indian regulations.

Yours sincerely,

9.5.25

Mr. Chinmaya Kumar Patra
Member Secretary
ABSMARI Ethics Committee
Pahal, Bhubaneswar

Member Secretary
ABSMARI ETHICS COMMITTEE

ABSMARI ETHICS COMMITTEE Dt. 9/5/25 BHUBANESWAR

2

Utkal Signature, Plot No.-273, Ground Floor, Pahal, Bhubaneswar-752101 +91-63707-03654 iec@absmari.com

ANNEXURES -2 INFORMED CONCENT

INFORMED CONSENT

Informed Consent form to participate in a clinical trial

Study Title: Development and validation of neurogenic bladder assessment questionnaire in Spinal cord injury.

Study Number:
Subject 's Name: _____ Subject 's Initials: _____
Date of Birth / Age: _____
Address of the Subject_____
Qualification _____
Occupation: Student/Self-Employed/ Service/Housewife/Others (Please tick as appropriate)

Annual Income of the subject _____ if applicable
Name and address of the nominee(s) and his relation to the subject _____ (for the purpose of compensation in case of trial related death).]

Please initial box
(Subject)

(i) I confirm that I have read and understood the information sheet dated _____ [ ] for the above study and have had the opportunity to ask questions.
(ii) I understand that my participation in the study is voluntary and that I am [ ] free to withdraw at any time, without giving any reason, without me medical care or legal rights being affected.
(iii) I understand that the Sponsor of the clinical trial, others working on the [ ] Sponsor 's behalf, the Ethics Committee and the regulatory authorities will not need my permission to look at my health records both in respect of the current study and any further research that may be conducted in relation to it, even if I withdraw from the trial. I agree to this access. However, I understand that my identity will not be revealed in any information released to third parties or published.
(iv) I agree not to restrict the use of any data or results that arise from this [ ] study provided such a use is only for scientific purpose(s)
(v) I agree to take part in the above study. [ ]

Signature (or Thumb impression) of the Subject/Legally Acceptable Representative:

_____

Date: ____/ ___/ ____
Signatory 's Name: _____
Signature of the Investigator: _____
Date: Study Investigator 's Name: _____
Signature of the Witness: _____
Date: _____/ _____/ _____
Name of the Witness: _____
*Copy of the Patient Information Sheet and duly filled Informed Consent Form shall be handled over to the subject or his/her attendant.

ANNEXURES-3 INITIAL PHASE QUESTIONNARE

NEUROGENIC BLADDER ASSESSMENT QUESTIONNAIRE

1. Frequency of Urination:

- How often do you urinate during the day?
- How often do you urinate at night?

2. Urgency:

- Do you feel a sudden, strong need to urinate?

3. Urinary Incontinence:

- Do you experience involuntary leakage of urine?
- If yes, how often does it occur?

4. Urine Retention:

- Do you have difficulty starting urination?
- Do you feel like your bladder is not completely empty after urinating?

5. Bladder Sensation:

- Can you feel when your bladder is full?
- Do you experience any unusual sensations when your bladder is full?

6. Spastic Bladder:

- Do you experience sudden bladder contractions leading to involuntary urine leakage?
- Do you have episodes of frequent urination in small amounts?
- Have you been diagnosed with detrusor hyperreflexia?
- Do you feel a strong, sudden urge to urinate?

8. Bladder Spasms:

- Do you experience painful bladder spasms?

9. Flaccid Bladder:

- Do you have a weak or absent bladder contraction?
- Is it difficult for you to initiate urination?
- Have you been diagnosed with an areflexic bladder?
- Do you experience large amounts of urine leakage without any sensation or warning?

ANNEXURES-4 REVISED QUESTIONNAIRE -1

Neurogenic Bladder Dysfunction Questionnaire

Uninhabited bladder or cortical bladder

1. How often do you feel the need to urinate during the day time?
2. Are you aware of when your bladder is full?
3. Did you experience that you have already passed urine and you are not aware of it?
4. How often do you find it difficult to hold your urine once your bladder feels full?
5. Have you had any incidents where you couldn't make it to the toilet in time and urinated in your pants?

Autonomous or LMN type of bladder

1. Do you frequently feel like you haven't completely emptied your bladder after urinating?
2. Do you often feel the need to urinate again shortly after finishing?
3. Do you take a longer time to urinate but still feel unsatisfied afterward?
4. Is your urine flow slow or interrupted with small, frequent urinations?
5. Have you been diagnosed with a urinary tract infection, and how often do you experience symptoms related to it?
6. Do you feel pain while urinating?

Automatic or UMN type of bladder

1. Do you frequently feel the need to urinate but only pass a small amount of urine?
2. How often do you experience the sensation of needing to urinate?
3. Do you sometimes feel like you need to urinate but are unable to do so?
4. Do you feel pain while urinating?
5. Do you have difficulty fully emptying your bladder?

Sensory paralytic bladder:

1. Do you experience a reduced or absent sensation of bladder fullness?
2. Are you often unable to sense when your bladder is full, leading to unexpected leakage?
3. Do you find that you do not feel the usual urge to urinate, even when your bladder is full?
4. Have you noticed that you need to consciously remember to urinate because you don't feel the need naturally?
5. Do you often find yourself retaining urine for long periods without realizing it?

Motor paralytic bladder

1. Do you experience severe pain or discomfort in your lower abdomen or pelvic area when your bladder is full?
2. Have you noticed a sharp or stabbing pain when trying to initiate urination?
3. Do you find it difficult or painful to completely empty your bladder when you urinate?
4. Have you had episodes where you experienced intense pain or discomfort when your bladder was full but couldn't pass urine?
5. Are there times when you feel a significant increase in pain or discomfort as your bladder fills with urine?

ANNEXURES-5 REVISED QUESTIONNAIRE -2

NEUROGENIC BLADDER ASSESSMENT QUESTIONNAIRE (FOR SCI PATIENTS

AUTONOMOUS or LMN Type of BLADDER

1. Do you feel like you haven't completely emptied the bladder after urination?
   ( ) Yes ( ) No ( ) Maybe
2. Do you feel to urinate again shortly after finishing?
   ( ) Yes ( ) No ( ) Maybe
3. Do you feel leakage of urine without any sensation or warning?
   ( ) Yes ( ) No ( ) Maybe
4. Do you have weak or absent bladder contraction during urination?
   ( ) Yes ( ) No ( ) Maybe
5. How is your flow of urine (Slow and frequent, small and frequent)?
   ( ) Yes ( ) No ( ) Maybe
6. Do you feel unsatisfied after urination?
   ( ) Yes ( ) No ( ) Maybe

SCORING:
0= NO
1= MAYBE
2= YES

AUTOMATIC or UMN Type of Bladder

1. Do you feel sudden urge to urinate leading to involuntary urine leakage?
   ( ) Yes ( ) No ( ) Maybe
2. Do you frequently experience the urge to urinate?
   ( ) Yes ( ) No ( ) Maybe
3. Do you experience a sudden strong urge to urinate but unable to urinate?
   ( ) Yes ( ) No ( ) Maybe
4. Do you feel pain while urinating?
   ( ) Yes ( ) No ( ) Maybe
5. Do you feel dissatisfied or have difficulty in fully emptying your bladder?
   ( ) Yes ( ) No ( ) Maybe
6. Do you feel the episodes of frequent urination in small amounts?
   ( ) Yes ( ) No ( ) Maybe

MIXED TYPE Bladder

1. Do you feel the need to urinate frequently?
   ( ) Yes ( ) No ( ) Maybe
2. Do you experience a sudden, strong urge to urinate?
   ( ) Yes ( ) No ( ) Maybe
3. Do you have difficulty initiating urination or experiencing a weak stream?
   ( ) Yes ( ) No ( ) Maybe
4. Do you feel the bladder is not emptied after urination?
   ( ) Yes ( ) No ( ) Maybe
5. Do you experience urinary leakage or incontinence frequently?
   ( ) Yes ( ) No ( ) Maybe
6. Do you wake up at night to urinate (nocturia- 3 to 4 times)?
   ( ) Yes ( ) No ( ) Maybe

1. Neurogenic bladder assessment questionnaire in sci, can be used to assess the types bladder in spinal cord injury patients.
2. It is an 18-item questionnaire that test 3 areas of bladder type: LMN, UMN and mixed. The maximum score in each type of bladder is 12.
3. To confirm the type of bladder the subject has to score 7-12 in one segment, less than 7 will not confirm the diagnosis. If a subject is scoring less than 7 in both or 7-12 in both then it is considered as mixed type.

ANNEXURES-6 FINAL QUESTIONNAIRE

NEUROGENIC BLADDER ASSESSMENT QUESTIONNAIRE (FOR SCI PATIENTS WITHOUT CATHETERIZATION)

AUTONOMOUS or LMN Type of BLADDER

1. Do you feel like you haven't completely emptied the bladder after urination?
   ( ) Yes ( ) No ( ) Maybe
2. Do you feel to urinate again shortly after finishing?
   ( ) Yes ( ) No ( ) Maybe
3. Do you feel leakage of urine without any sensation or warning?
   ( ) Yes ( ) No ( ) Maybe
4. Do you have weak or absent bladder contraction during urination?
   ( ) Yes ( ) No ( ) Maybe
5. How is your flow of urine (Slow and frequent, small and frequent)?
   ( ) Yes ( ) No ( ) Maybe
6. Do you feel unsatisfied after urination?
   ( ) Yes ( ) No ( ) Maybe

SCORING:
0= NO
1= MAYBE
2= YES

AUTOMATIC or UMN Type of Bladder

1. Do you feel sudden urge to urinate leading to involuntary urine leakage?
   ( ) Yes ( ) No ( ) Maybe
2. Do you frequently experience the urge to urinate?
   ( ) Yes ( ) No ( ) Maybe
3. Do you experience a sudden strong urge to urinate but unable to urinate?
   ( ) Yes ( ) No ( ) Maybe
4. Do you feel pain while urinating?
   ( ) Yes ( ) No ( ) Maybe
5. Do you feel dissatisfied or have difficulty in fully emptying your bladder?
   ( ) Yes ( ) No ( ) Maybe
6. Do you feel the episodes of frequent urination in small amounts?
   ( ) Yes ( ) No ( ) Maybe

MIXED TYPE Bladder

1. Do you feel the need to urinate frequently?
   ( ) Yes ( ) No ( ) Maybe
2. Do you experience a sudden, strong urge to urinate?
   ( ) Yes ( ) No ( ) Maybe
3. Do you have difficulty initiating urination or experiencing a weak stream?
   ( ) Yes ( ) No ( ) Maybe
4. Do you feel the bladder is not emptied after urination?
   ( ) Yes ( ) No ( ) Maybe
5. Do you experience urinary leakage or incontinence frequently?
   ( ) Yes ( ) No ( ) Maybe
6. Do you wake up at night to urinate (nocturia- 3 to 4 times)?
   ( ) Yes ( ) No ( ) Maybe

1. Neurogenic bladder assessment questionnaire in sci, can be used to assess the types bladder in spinal cord injury patients.
2. It is an 18-item questionnaire that test 3 areas of bladder type: LMN, UMN and mixed. The maximum score in each type of bladder is 12.
3. To confirm the type of bladder the subject has to score 7-12 in one segment ,less than 7 will not confirm the diagnosis .If a subject is scoring less than 7 in both or 7-12 in both then it is considered as mixed type.

ANNEXURES-7

TO WHOMSOEVER IT MAY CONCERN

This is to certify that the research titled *"**Development and Validation of Neurogenic Bladder Assessment Questionnaire in Spinal Cord Injury**"*, prepared by **Miss. Ananya Mansingh, MPT (Neurology)** student of **ABSMARI**, BBSR, has been thoroughly reviewed by the undersigned as part of the expert panel.

As an expert **Neuro-physiotherapist** and panel member, I have meticulously examined the questionnaire for clinical relevance, content validity, and appropriateness for the target population. Based on this review, I have provided constructive feedback and assigned the validation scores in accordance with the established evaluation criteria.

This certification is issued upon completion of the review process as part of the research validation procedure.

(Signature with seal of the Expert committee member)

ANNEXURES-8

TO WHOMSOEVER IT MAY CONCERN

This is to certify that the research titled "***Development and Validation of Neurogenic Bladder Assessment Questionnaire in Spinal Cord Injury***", prepared by **Miss. Ananya Mansingh, MPT (Neurology)** student of **ABSMARI**, BBSR, has been thoroughly reviewed by the undersigned as part of the expert panel.

As an expert **urologist** and panel member, I have meticulously examined the questionnaire for clinical relevance, content validity, and appropriateness for the target population. Based on this review, I have provided constructive feedback and assigned the validation scores in accordance with the established evaluation criteria.

This certification is issued upon completion of the review process as part of the research validation procedure.

(Signature with seal of the Expert committee member)

DR. NISITH RANJAN KABAT
MBBS,MS,Mch(UROLOGY)&D:NB(UROLOGY)
ASSISTANT PROFESSOR
DEPT. OF UROLOGY, REGD. NO :19038
IMS & SUM HOSPITAL, BBSR

ANNEXURES-9

TO WHOMSOEVER IT MAY CONCERN

This is to certify that the research titled *"**Development and Validation of Neurogenic Bladder Assessment Questionnaire in Spinal Cord Injury**"*, prepared by **Miss. Ananya Mansingh, MPT (Neurology)** student of **ABSMARI**, BBSR, has been thoroughly reviewed by the undersigned as part of the expert panel.

As an expert **Neuro-physiotherapist** and panel member, I have meticulously examined the questionnaire for clinical relevance, content validity, and appropriateness for the target population. Based on this review, I have provided constructive feedback and assigned the validation scores in accordance with the established evaluation criteria.

This certification is issued upon completion of the review process as part of the research validation procedure.

Dr. Girijashankar Khuntia (PT)
(Signature with seal of the Expert committee member)

ANNEXURES-10

TO WHOMSOEVER IT MAY CONCERN

This is to certify that the research titled *"Development and Validation of Neurogenic Bladder Assessment Questionnaire in Spinal Cord Injury"*, prepared by **Miss. Ananya Mansingh, MPT (Neurology)** student of **ABSMARI**, BBSR, has been thoroughly reviewed by the undersigned as part of the expert panel.

As an expert **Neuro-physiotherapist** and panel member, I have meticulously examined the questionnaire for clinical relevance, content validity, and appropriateness for the target population. Based on this review, I have provided constructive feedback and assigned the validation scores in accordance with the established evaluation criteria.

This certification is issued upon completion of the review process as part of the research validation procedure.

Dr. Subhajit Behera (P.T)
Senior Physiotherapist
Department of Physiotherapy
S.C.B. SUM Hospital, BBSR

(Signature with seal of the Expert committee member)

ANNEXURES-11

TO WHOMSOEVER IT MAY CONCERN

This is to certify that the research titled *"**Development and Validation of Neurogenic Bladder Assessment Questionnaire in Spinal Cord Injury**"*, prepared by **Miss. Ananya Mansingh, MPT (Neurology)** student of **ABSMARI**, BBSR, has been thoroughly reviewed by the undersigned as part of the expert panel.

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This certification is issued upon completion of the review process as part of the research validation procedure.

(Signature with seal of the Expert committee member)

ANNEXURES-12

TO WHOMSOEVER IT MAY CONCERN

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As an expert **Neuro-physiotherapist** and panel member, I have meticulously examined the questionnaire for clinical relevance, content validity, and appropriateness for the target population. Based on this review, I have provided constructive feedback and assigned the validation scores in accordance with the established evaluation criteria.

This certification is issued upon completion of the review process as part of the research validation procedure.

Dr. Soumya Ranjan Mohapatra (PT)
(Signature with seal of the Expert committee member)

ANNEXURES-13 STUDY SETTING

TO WHOM SO EVER IT MAY CONCERN

This is to certify that Dr./Mr./Mrs./Ms. Aranya Manisha from ABSMARI has worked under my supervision for his/her research work from dated 23/05/25, 27/05/25 & 09/06/25 to _____ under the following details.

Title -: Development and validation of Neurogenic bladder Assessment questionnaire in spinal cord injury.

Population -: Spinal cord Injury

Study Settings -: Regional spinal cord injury centre

Duty Hour -: 10 am - 4.30 pm

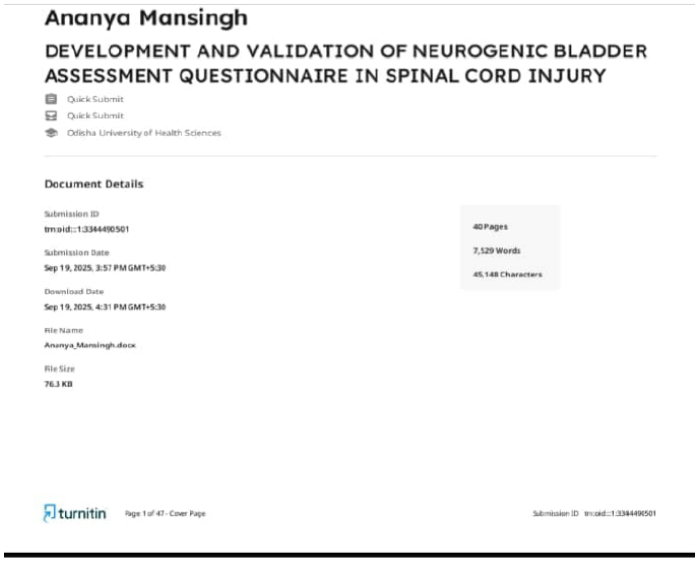
9/6/25

Authorized Signatory with Stamp

ANNEXURES-14 MASTER CHART

SL.NO	AGE	GENDER	TYPES	CATHETERIZATION	LMN	UMN	MIXED	PROBLEM STATEMENT
1	35	MALE	post operative SCI	yes	4	0	0	during flow of urine in catheter patient is able to recognise the flow, but can't feel the contaction in pelvic area
2	33	MALE	sci	yes	0	0	4	patient can feel the bladder contraction .with catheter, pt can feel overflow of urine
3	42	MALE	sci	yes	6	0	0	due to catheterization patient is unable to answer many question regarding sensation
4	23	MALE	SCI	YES				due to catheterization patient is unable to answer .
5	35	MALE	SCI	NO	0	8		More amount of urine passes
6	52	MALE	SCI	YES	4	O	O	He can feel minimal bladder contraction with catheter &also experience burning like sensation
7	28	MALE	sci	yes	0	4		during clamping
8	20	MALE	SCI	YES	4	0	0	He can feel minimal bladder contraction with catheter &also experience burning like sensation
9	36	MALE	sci	yes	4	0	0	
10	28	MALE	SCI	YES	1	0	0	can feel minimal contraction
11	55	MALE	SCI	YES	NT	NT	NT	
12	55	MALE	SCI	YES	2	O		he can feel when urine passess through the catheter
13	50	MALE	sci	yes	4	0	2	
14	54	MALE	sci	yes	4	0	6	
15	45	MALE	MYELOPATHY	NO	O	10		
16	44	MALE	SCI	NO	0	6	8	
17	32	MALE	SCI	YES	6	0	0	due to catheterization patient is unable to answer many question regarding sensation
18	68	FEMALE	SCI(non trumatic)	yes	NT	NT	NT	due to catheterization patient is unable to answer many question regarding sensation
19	65	FEMALE	SCI	YES	0	2		due to catheterization patient is unable to answer many question regarding sensation
20	57	MALE	Myeloradiculopathy	yes	6	0	0	Not able to ans.almost all question of 3rd section due to catheterization.pain at lower abdomen,tightness and band like sensation feeling at lower abdomen.
21	69	MALE	Cauda equina syndrome	yes	6	0	0	lower abdomen pain
22	64	MALE	SCI	YES	4	0		Not able to ans.almost all question of 3rd section due to catheterization
23	40	FEMALE	Cervical Myelopathy	no	0	9		fullness of lower abdomen
24	54	FEMALE	SCI	NO	0	8		
25	30	MALE	SCI	YES	8	2		
26	35	FEMALE	Trasverse myelitis	no	0	8		felling band like sensation ,pain and discomfort in lower abdomen
27	25	MALE	sci	yes	0	8		fast urine flow (3-4 times),past data -without catheter
28	57	MALE	SCI	YES	O	10		past data -without catheter
29	49	MALE	SCI (T6-T7 -MASS)	NO	O	2	0	
30	26	MALE	SCI	yes	8	0		past data -without catheter

ANNEXURES-15



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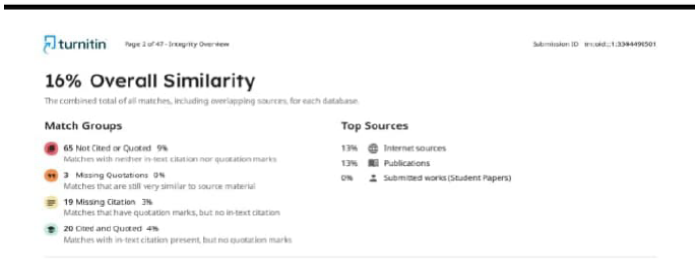

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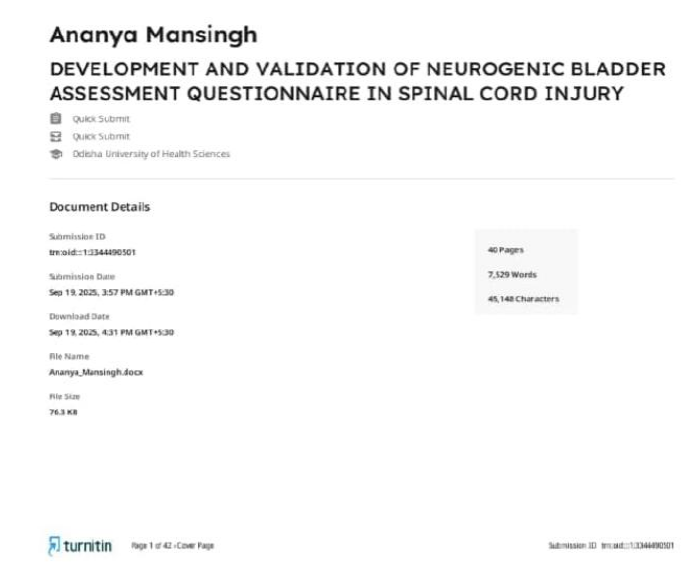

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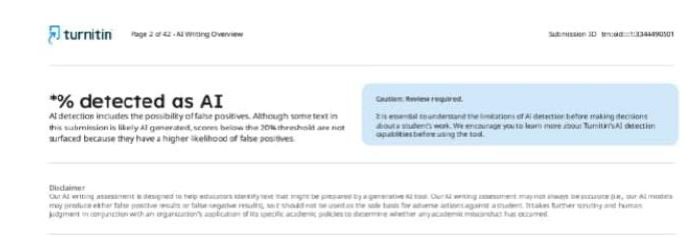

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