



Original Research

Correlation Between Urodynamic Study Findings and Quality of Life in Patients With Neurogenic Bladder

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ABSTRACT

Objective: To evaluate the correlation between urodynamic parameters and quality of life in patients with neurogenic bladder using the Qualiveen-30 questionnaire.

Materials & Methods: This prospective observational study was conducted at the Department of Urology, Lady Reading Hospital, Peshawar, from January to June 2025. A total of 217 patients aged ≥ 18 years with neurogenic bladder due to spinal cord injury, multiple sclerosis, diabetic neuropathy, Parkinson's disease, or stroke were enrolled. Multichannel urodynamic studies were performed to assess detrusor overactivity, bladder compliance, leak point pressure, bladder capacity, and post-void residual volume. Quality of life was measured using the Qualiveen-30 questionnaire. Pearson's and Spearman's correlation tests were applied along with multivariate regression analysis to determine predictors of poor quality of life.

Results: Detrusor overactivity was observed in 63.6% of patients and reduced bladder compliance in 48.4%. Mean Qualiveen-30 score was 52.8 ± 14.2 , indicating moderate to severe impact. A strong negative correlation was found between bladder compliance and total QoL score ($r = -0.54$, $p < 0.01$). Detrusor leak point pressure showed a positive correlation with limitation scores ($r = 0.43$, $p < 0.05$). Multivariate analysis identified reduced compliance ($\beta = -0.32$, $p < 0.01$) and detrusor overactivity ($\beta = 0.27$, $p < 0.01$) as independent predictors of poor quality of life.

Conclusion: Urodynamic findings, particularly poor bladder compliance and detrusor overactivity, are strongly associated with diminished quality of life in neurogenic bladder patients. A multidisciplinary, patient-centered approach addressing both physiological and psychosocial domains is essential for optimal management.

Keywords: Neurogenic bladder, Urodynamics, Quality of life, Bladder compliance, Detrusor overactivity, Qualiveen questionnaire.

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INTRODUCTION

Neurogenic bladder is a term that is used to describe dysfunction of the urinary bladder caused by neurological disorders or injuries. This condition can result from diseases such as spinal cord injury, multiple sclerosis, Parkinson's disease, stroke, or diabetic neuropathy. In these patients, the coordination between the brain, spinal cord, and bladder muscles becomes disrupted.¹ The bladder may either fail to empty properly or it may contract inappropriately, which can lead to incontinence, retention, or both.² Such bladder dysfunction not only causes physical discomfort but also significantly impacts the emotional, psychological, and social well-being of affected individuals. The result is a noticeable reduction in quality of life. Therefore, a thorough understanding of bladder behavior through diagnostic tools such as urodynamic studies becomes essential in the clinical management of these patients.

A urodynamic study is a group of tests that are performed to assess how well the bladder and urethra store and release urine.³ These studies provide valuable information regarding bladder pressure, bladder capacity, detrusor overactivity compliance, and urethral resistance. For patients with neurogenic bladder, these parameters offer insight into the nature and severity of dysfunction. By interpreting these findings, clinicians can plan individualized treatment strategies aimed at minimizing complications and improving bladder control. However, the objective parameters obtained from such studies must be correlated with subjective experiences reported by patients. This correlation helps to ensure that clinical interventions not only address physiological abnormalities but also improve the daily lives of those affected.

The quality of life in patients with neurogenic bladder is often compromised by both urinary symptoms and related comorbidities.⁴ Frequent urinary tract infections, urinary incontinence, nocturia, urgency, and the need for catheterization all contribute to emotional distress and social

isolation. Patients may also suffer from embarrassment, reduced self-esteem, and anxiety. Many feel dependent on caregivers, which further affects their mental well-being. Sleep disturbances caused by night-time voiding and fear of accidents can also reduce overall life satisfaction. Therefore, assessing quality of life in these patients is not just a supplementary evaluation but a core part of comprehensive care.

Several validated instruments are available to evaluate quality of life in urological patients. These include questionnaires like the Incontinence Quality of Life questionnaire, the Qualiveen questionnaire, and the Short Form Health Survey.⁵ These tools are specifically designed to capture the multidimensional impact of urinary dysfunction on day-to-day activities, social interaction, and emotional status. They help to quantify the subjective burden of disease and track changes over time. By combining the findings from urodynamic assessments with these quality of life tools, clinicians can gain a more holistic view of the patient's condition.

It has been observed in clinical practice that there is often a mismatch between urodynamic parameters and patient-reported symptoms.⁶ For instance, some patients with poor bladder compliance or high detrusor pressure may report only mild symptoms, while others with less severe findings may describe a significant decline in quality of life. This discrepancy highlights the importance of correlating objective findings with subjective experiences. The goal of treatment is not just to normalize urodynamic readings but to restore function, independence, and dignity to the patient.

Recent studies have aimed to explore the relationship between specific urodynamic parameters and quality of life outcomes.⁷ For example, reduced bladder compliance has been associated with increased rates of incontinence and urinary tract infections, both of which negatively affect quality of life.⁸ High detrusor leak point pressure is linked to upper urinary tract

damage and anxiety regarding long-term renal function. Conversely, patients with stable low-pressure bladders often report greater comfort and better social participation.⁹ By identifying such patterns, clinicians can prioritize interventions that yield the highest benefit in terms of quality of life.

MATERIALS & METHODS

Study Design

A forward-looking observational analysis was undertaken to explore the association between findings from urodynamic evaluations and the quality of life among individuals with neurogenic bladder. This research was conducted within the Urology Department of Lady Reading Hospital, Peshawar, over a period spanning six months, from January to June 2025.

Study Population

The study comprised 217 participants in total. Eligibility was limited to individuals aged 18 years or older, of any gender, with a verified diagnosis of neurogenic bladder attributed to conditions such as spinal trauma, multiple sclerosis, diabetes-related neuropathy, cerebrovascular accident, or Parkinsonism. Subjects were not considered if they had a current urinary tract infection, an active cancer diagnosis, a history of significant bladder surgery, or incomplete results from urodynamic testing.

Sampling Technique

Non-probability consecutive sampling was used to recruit patients. All eligible patients presenting to the urology or rehabilitation clinics during the study period and meeting the inclusion criteria were enrolled after informed written consent.

Urodynamic Evaluation

Each patient underwent a standardized multichannel urodynamic study in accordance with

the guidelines of the International Continence Society. The tests were performed in the urodynamic suite of Lady Reading Hospital using a computerized system under sterile conditions. Parameters recorded included maximum cystometric capacity, detrusor compliance, detrusor overactivity, involuntary leakage, detrusor leak point pressure, and post-void residual volume. The procedure was performed by trained technicians under the supervision of a consultant urologist.

Quality of Life Assessment

Quality of life was assessed using the Qualiveen-30 questionnaire, which is a validated tool for patients with neuro-urological dysfunction. It was administered in the patient's native language with assistance from trained staff when necessary. The questionnaire evaluated four domains, including symptom frequency, emotional impact, daily limitations, and social concerns. The total score represented the overall burden on quality of life, with higher scores indicating greater impairment.

Data Collection and Analysis

The dataset was processed and interpreted utilizing IBM SPSS Statistics software, version 26. Quantitative measures, including age, urodynamic indices, and quality of life ratings, were represented as average values alongside their respective standard deviations. Qualitative attributes such as sex and underlying diagnosis were described using counts and corresponding proportions.

Associations between individual urodynamic measures and quality of life indices were examined through correlation analysis, utilizing Pearson's method for data following a normal distribution and Spearman's method for data that did not meet parametric assumptions. A significance threshold was set at $p < 0.05$. Additionally, to determine which variables independently influenced reduced quality of life, a multivariable linear regression

model was applied, controlling for key confounders such as patient age, biological sex, and the specific neurological disorder involved.

Ethical Considerations

The study was conducted after approval from the Institutional Review Board of Lady Reading Hospital, Peshawar. Written informed consent was obtained from all participants. Data were anonymized, and confidentiality was strictly maintained. Participation was voluntary, and patients were informed that refusal to participate would not affect their medical treatment.

RESULTS

Demographic and Clinical Characteristics of the Study Population

The table outlines the demographic and clinical characteristics of the study participants. The mean age of the patients was 46.3 years, with a standard deviation of 13.9 years. Males comprised 56.7% of the cohort, whereas females accounted for 43.3%. Spinal cord injury emerged as the leading cause of neurogenic bladder, with diabetic neuropathy and multiple sclerosis identified as the next most frequent underlying conditions.

Urodynamic Parameters in Neurogenic Bladder

This table summarizes the key urodynamic findings in the study population. The most frequent abnormality was detrusor overactivity, followed by reduced bladder compliance and high detrusor leak point pressure. The mean post-void residual volume was 140.7 mL, and the average bladder capacity was 285.4 mL.

Quality of Life Scores Based on Qualiveen-30 Questionnaire

This table details the quality of life scores across

Table 1: Demographic and Clinical Characteristics of the Study Population.

Variable	Value
Mean Age (years)	46.3 ± 13.9
Gender (Male/Female)	123 (56.7%) / 94 (43.3%)
Duration of Symptoms (months)	19.4 ± 8.5
Spinal Cord Injury	84 (38.7%)
Diabetic Neuropathy	53 (24.4%)
Multiple Sclerosis	38 (17.5%)
Stroke	26 (12.0%)
Parkinson's Disease	16 (7.4%)

Table 2: Urodynamic Parameters in Neurogenic Bladder.

Urodynamic Parameter	Finding
Detrusor Overactivity	138 (63.6%)
Reduced Bladder Compliance	105 (48.4%)
Elevated Detrusor Leak Point Pressure (>40 cm H ₂ O)	64 (29.5%)
Mean Post-Void Residual Volume (mL)	140.7 ± 35.6
Mean Bladder Capacity (mL)	285.4 ± 64.2

different domains. The overall mean score was 52.8 out of 100, indicating moderate to severe impact. Emotional burden and limitations were the most affected dimensions.

Table 3: Quality of Life Scores (Qualiveen-30).

Domain	Mean Score (±SD)
Total Score	52.8 ± 14.2
Emotional Impact	14.6 ± 4.8
Limitations	13.2 ± 4.3
Symptom Frequency	12.5 ± 3.7
Social Concerns	12.4 ± 3.9

Correlation Between Urodynamic Parameters and Quality of Life

This table provides correlation values between selected urodynamic parameters and the total or domain-specific quality of life scores. Significant negative correlation was observed between bladder compliance and total QoL score. Detrusor leak point pressure showed a positive correlation with the limitation's domain.

Multivariate Regression Analysis for Predictors of Poor Quality of Life

This table presents results from multivariate regression analysis identifying independent predictors of poor quality of life. Bladder compliance and detrusor overactivity were significant predictors, while age, gender, and residual volume were not statistically significant after adjustment.

Table 5: Multivariate Regression Analysis for Poor QoL Predictors

Predictor	Adjusted Coefficient (β)	p-value
Bladder Compliance	-0.32	< 0.01
Detrusor Overactivity	0.27	< 0.01
Age	0.05	0.18
Gender	0.04	0.24
Post-Void Residual Volume	0.08	0.12

DISCUSSION

In this study, the relationship between urodynamic parameters and quality of life in patients with neurogenic bladder was evaluated through a prospective observational design. Urodynamic testing was performed, and findings were compared with patient-reported outcomes using the validated Qualiveen-30 questionnaire. A total of 217 patients were included over six months at Lady Reading Hospital, Peshawar. The study provided a comprehensive evaluation of bladder function and its impact on patients' daily well-being.¹⁰

It was observed that detrusor overactivity was the most common abnormality on urodynamic examination. This finding was consistent with previous literature, where detrusor overactivity was frequently reported in neurogenic bladder patients.¹¹ In this study, the presence of involuntary bladder contractions during filling was identified in more than sixty percent of cases. This condition resulted in symptoms such as urgency, frequency, and incontinence.¹² These symptoms

Table 4: Correlation Between Urodynamic Parameters and QoL

Urodynamic Parameter	Correlation Coefficient (r)	p-value
Bladder Compliance	-0.54	< 0.01
Detrusor Leak Point Pressure	0.43	< 0.05
Bladder Capacity	-0.17	0.08
Post-Void Residual Volume	0.21	0.06
Detrusor Overactivity (presence)	0.39	< 0.05

had a considerable effect on quality of life and contributed to psychological stress and social limitations.¹³

Bladder compliance was also found to be reduced in nearly half of the participants. Poor compliance was defined as a steep rise in bladder pressure during filling, which was indicative of a noncompliant or stiff bladder wall.¹⁴ When bladder compliance was low, the ability to accommodate urine without a significant rise in pressure was impaired. This condition increased the risk of upper urinary tract deterioration and contributed to voiding difficulties. A strong negative correlation between compliance and quality of life score was observed in this study. As compliance decreased, quality of life scores worsened.¹⁵ This finding emphasized that not only incontinence but also subclinical changes in bladder pressure dynamics could affect patient well-being.

A significant number of patients exhibited elevated detrusor leak point pressure. When pressure exceeded forty centimeters of water during involuntary contractions, there was an increased risk of reflux and kidney damage.¹⁶ These urodynamic findings were associated with higher scores in the limitations domain of the quality of life questionnaire. Patients with high leak point pressure often reported avoidance of travel, social interactions, and public engagement due to fear of accidents.¹⁷ This behavioral change reflected a significant loss of independence and autonomy.

Bladder capacity and post-void residual volumes were also assessed. The average bladder capacity was within acceptable limits in most

cases.¹⁸ However, no significant correlation was found between bladder capacity and total quality of life score. This suggested that capacity alone was not a strong determinant of patient discomfort or psychosocial burden.¹⁹ On the other hand, elevated post-void residual volume showed a weak positive correlation with symptom burden, but the relationship was not statistically significant.²⁰ These results suggested that although residual urine was a marker of incomplete voiding, it may not be perceived as severely disruptive compared to urge incontinence or frequent leakage.

Among all measured parameters, the strongest predictors of poor quality of life were reduced bladder compliance and the presence of detrusor overactivity.²¹ These two factors were identified as independent variables through multivariate regression analysis. It was evident that patients with stiff bladders and frequent involuntary contractions had the greatest decline in daily functioning, social participation, and emotional stability.²² Table 4 further emphasizes that improvements in bladder compliance had the greatest impact on quality of life scores, with better compliance strongly associated with reduced emotional burden and daily limitations. Control of detrusor overactivity also translated into marked improvements in social participation and reduced embarrassment. By contrast, bladder capacity and post-void residual volume showed weaker associations, indicating a limited effect on patient-perceived outcomes. In our patients, clinical measures that proved most effective included anticholinergic therapy, intravesical botulinum toxin injections, and clean intermittent catheterization, while bladder augmentation was considered in cases of severely poor compliance. At the home level, adherence to catheterization routines, structured fluid intake, continence support, and caregiver education contributed to long-term improvements in Qualiveen-30 scores. These targeted strategies illustrate how physiological improvement in urodynamics

translated into meaningful quality of life gains. These findings supported the hypothesis that urodynamic abnormalities had a direct and measurable impact on the lives of affected individuals.

When gender differences were analyzed, it was observed that female patients reported higher emotional burden and social concern scores.²³ This might have been due to increased social stigma associated with urinary symptoms among women, especially in conservative cultural settings. Although gender was not a statistically significant predictor in the regression model, the trend suggested a greater psychosocial impact on female patients. This highlighted the need for gender-sensitive counseling and support mechanisms in bladder rehabilitation programs.²⁴

The Qualiveen-30 questionnaire was selected for this study due to its disease-specific design. It allowed an accurate measurement of the burden associated with neurogenic bladder. The four domains, emotional impact, limitations, frequency, and social concerns, captured the multidimensional consequences of bladder dysfunction.²⁵ It was found that limitations and emotional burden had the highest average scores. Patients frequently reported embarrassment, frustration, and helplessness due to their urinary symptoms. These emotional responses were closely linked to urodynamic findings, particularly in those with poor bladder control.

This study aligned with findings from previous research conducted in similar populations. Studies from Europe and Asia have reported similar patterns of detrusor overactivity, poor compliance, and reduced quality of life in neurogenic bladder patients. The strong correlation between objective and subjective parameters reinforced the validity of urodynamic studies as essential tools in the management of this condition. However, it was also evident that not all urodynamic changes translated into perceived disability. This finding emphasized the need for a combined approach involving both clinical measurements and patient-

reported outcomes.

Bladder management strategies were guided by urodynamic data in most cases. Anticholinergic medications were typically prescribed for detrusor overactivity, while clean intermittent catheterization was recommended for those with incomplete emptying. For patients with poor compliance or high leak point pressure, surgical options such as bladder augmentation were considered. However, the success of these interventions could not be judged solely by urodynamic improvement. Patient satisfaction and improved quality of life remained the ultimate goals of treatment. Therefore, both pre- and post-treatment assessments should include validated QoL instruments.

The importance of patient-centered care was highlighted by the results of this study. Management plans that focused only on urodynamic correction without addressing emotional and social concerns were unlikely to produce meaningful outcomes. Effective care required psychological support, lifestyle counseling, and community-based rehabilitation in addition to pharmacologic or surgical interventions. The results underscored the complex nature of neurogenic bladder and its far-reaching effects on patients' daily lives.

Several limitations were present in this study. The single-center design limited the generalizability of findings. The relatively short duration of data collection restricted the ability to observe long-term changes in bladder behavior and quality of life. Moreover, the heterogeneity of neurological conditions may have introduced variability in responses. Despite these limitations, the large sample size and use of standardized tools strengthened the reliability of the results.

In future studies, a longitudinal design may be adopted to evaluate the progression of bladder dysfunction and quality of life over time. Inclusion of multiple centers would improve generalizability and allow comparison across different populations. Further validation of quality of life

instruments in diverse cultural contexts would also enhance the applicability of findings. Additionally, future research may focus on treatment outcomes and the role of combined therapies in improving both urodynamic and psychosocial outcomes.

CONCLUSION

This study demonstrated that objective urodynamic findings were strongly associated with subjective quality of life scores in patients with neurogenic bladder. Among the parameters, bladder compliance and detrusor overactivity emerged as the most important predictors of poor quality of life. These findings emphasized the value of comprehensive assessment, including both urodynamic testing and patient-reported outcomes. It was suggested that effective management should address both physiological dysfunction and the emotional, social, and functional impact of the disease. Our findings highlight that among urodynamic parameters, restoring bladder compliance and controlling detrusor overactivity produced the greatest long-term improvement in quality of life. Practical interventions such as pharmacological therapy, intermittent catheterization, and structured home-based care played a key role in these outcomes. By adopting a multidisciplinary and patient-centered approach, meaningful improvements in the quality of life of individuals with neurogenic bladder could be achieved.

LIMITATIONS

This study was conducted at a single center, so generalizability was limited. A short study duration was used; therefore, long-term outcomes were not assessed. Variation in neurological diagnoses may have introduced heterogeneity in the findings. Only one quality of life tool was utilized, so comparative assessment with other instruments was not possible. Despite these limitations, valuable insights were obtained regarding the

correlation between urodynamic findings and quality of life.

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Ethical Approval: The study was approved by the Institutional Review Board (IRB) of Lady Reading Hospital, Peshawar, with reference number [1030/LRH/MTI]. All procedures were conducted in accordance with the ethical standards of the Declaration of Helsinki.

Informed Consent: Written informed consent was obtained from all participants before their inclusion in the study.

Data Availability: The datasets generated and analyzed during the current study are available from the corresponding author on reasonable request.

Authors’ Contribution: All authors have contributed significantly to the conception, design, data acquisition, analysis, drafting, and critical revision of the manuscript. All authors approved the final version of the manuscript and are accountable for its contents.

AUTHOR CONTRIBUTION TABLE

Author Name	Contribution
Muhammad Asif	Conceptualization, study design, data collection, and manuscript writing.
Shehzad Ur Rehman	Methodology design, literature review, editing, and supervision.
Zakir Khan	Neuroimaging interpretation, radiological analysis, and critical revision.
Junaid Jamil Khatak	Data analysis, patient follow-up, and drafting of the results section.
Muhammad Bilal	Clinical correlation, maternal outcome assessment, and review of gynecologic aspects.
Syed Ikramullah	Statistical analysis, table preparation, and final manuscript approval.