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An Evaluation of the Postvoid Residual Urine Volume in Acute Stroke Patients in Pakistan

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ABSTRACT

Background: Postvoid residual urine volume is a critical indicator of bladder dysfunction, particularly in acute stroke patients who may experience neurological impairments affecting urinary control. Objective: This study aims to evaluate postvoid residual urine volume in acute stroke patients and its association with stroke severity, mobility status, and comorbidities. **Methods:** This prospective observational study was conducted at Shalamar Hospital Lahore during June 2023 to May 2024. A total of 105 patients were added in the study. All demographic data were systematically recorded, including age, sex, stroke type (ischemic or hemorrhagic), stroke location, stroke severity, mobility status, and pre-existing comorbidities such as hypertension and diabetes. **Results:** The mean age of patients was 58.2 ± 11.8 years, with 63 males (60%) and 42 females (40%). Ischemic stroke was more prevalent (75.2%) compared to hemorrhagic stroke (24.8%). The mean NIHSS score was 14.6 ± 6.1, indicating moderate to severe neurological impairment. High postvoid residual urine volume was observed in 58 patients (55.2%), while 47 patients (44.8%) had normal postvoid residual urine volume. Among ischemic stroke patients, 20 (24.1%) had high postvoid residual urine volume, whereas 7 (28%) of hemorrhagic stroke patients exhibited high postvoid residual urine volume. **Conclusion:** Postvoid residual urine volume is significantly elevated in many acute stroke patients, with over half experiencing urinary retention. This is strongly linked to stroke severity, reduced consciousness, and impaired mobility. Non-ambulatory patients face a higher risk, highlighting the impact of neurological deficits and physical inactivity on bladder dysfunction, emphasizing the need for targeted management strategies.

INTRODUCTION

Stroke is a major cause of disability worldwide, with a significant impact on various physiological functions, including the urinary system. Acute stroke patients commonly suffer from bladder dysfunction because of neurological damage leading to urinary incontinence along with retention or both conditions occurring simultaneously [1]. The critical indicator of bladder dysfunction among stroke patients involves measuring postvoid residual urine volume (PVR) as the remaining amount of urine in the bladder after passing urine. An increase in PVR values reveals poor bladder emptying and raises the risk of UTIs as well as bladder overdistension and prolonged renal damage [2]. Stroke-related bladder dysfunction develops because stroke damages areas controlling micturition such as the frontal cortex, basal ganglia, and pontine micturition center. The diagnostic results depend on where the stroke strikes and how serious it is because patients might create detrusor hyperreflexia, detrusor areflexia or detrusor-sphincter dyssynergia [3]. The various bladder dysfunctions create symptoms of urgency and incontinence and hesitancy and retention so doctors must thoroughly assess stroke patient bladder function. The health assessment of urinary function depends on PVR measurements to evaluate if individuals face risks from urinary retention problems [4].

Abnormalities in PVR readings appear frequently among stroke patients especially those with significant motor and sensory disabilities according to published research. Urinary retention predominantly affects stroke patients who suffer from brainstem or large hemispheric strokes as well as those who have restricted mobility and altered consciousness or neurologic conditions [5]. The urinary manifestations of small lacunar infarcts and mild stroke patients generally resolve following their improvement in neurological condition. High PVR values lead to increased infection risks and rehabilitation delays as well as making patients more likely to need long-term catheter use that raises their susceptibility to UTIs from catheters [6]. The healthcare assessment of PVR in stroke patients delivers consequences which exceed infection prevention and urinary management benefits [7]. Patients who present high PVR levels might need specialized interventions like bladder training combined with intermittent catheterization as well as pharmacological management because neurogenic bladder dysfunction exists. Detecting patients with elevated PVR levels will enable healthcare providers to use suitable interventions which simultaneously improve urinary health outcomes and decrease hospital stays while boosting the life quality for stroke patients. PVR monitoring creates a consistent framework for health professionals to determine appropriate administration of anticholinergic medication and alpha-blocker and other urological treatments for stroke patients [8].

Only limited information exists about how common urinary retention is among acute stroke patients along with their related risk factors [9]. Studies about urinary incontinence and detrusor overactivity receive most research attention but investigation of postvoid residual urine volume and its consequences remains scarce. Research should focus on identifying how stroke characteristics affect PVR abnormalities because urinary retention affects both rehabilitation treatments for stroke patients and their results [10]. This study aims to evaluate postvoid residual urine volume in acute stroke patients and its association with stroke severity, mobility status, and comorbidities.

METHODOLOGY

This prospective observational study was conducted at Shalamar Hospital Lahore during June 2023 to May 2024. A total of 105 patients were added in the study.

Inclusion Criteria

- Patients aged ≥18 years diagnosed with acute ischemic or hemorrhagic stroke.
- Patients admitted within 72 hours of stroke onset.

Exclusion Criteria

- Patients with a previous history of neurogenic bladder dysfunction (e.g., Parkinson's disease, multiple sclerosis, spinal cord injury).
- Patients with pre-existing urological disorders (e.g., benign prostatic hyperplasia, chronic urinary retention, or history of bladder surgery).

Data collection

A total of 105 acute stroke patients were enrolled in this study. All demographic data were systematically recorded, including age, sex, stroke type (ischemic or hemorrhagic), stroke location, stroke severity, mobility status, and pre-existing comorbidities such as hypertension and diabetes. The measurement of postvoid residual urine volume was performed using a bladder ultrasound scanner, a non-invasive and widely accepted method for assessing residual urine volume. Before the assessment began patients received instruction to void naturally. After typical voiding residents or physicians who received training used ultrasound to measure residual urine volume in a space of ten minutes. Any measured postvoid residual urine level greater than 100 mL was defined as abnormal since it indicated there was not complete bladder emptying. The same test for postvoid residual urine volume was administered to patients twice during their first 48 hours of hospitalization. Several neurological and functional assessments took place to determine how postvoid residual urine volume measurements linked to patient condition along with stroke severity. The National Institutes of Health Stroke Scale evaluated stroke severity and both Glasgow Coma Scale and Mini-Mental State added to assessment evaluations. The research examined patient mobility through separate categories of ambulatory and non-ambulatory groups in order to evaluate how mobility affects urinary function.

Data Analysis

Data were analyzed using SPSS software version 25. Descriptive statistics were applied to determine baseline characteristics such as mean, standard deviation, and frequency distribution. Comparative analyses were conducted using the chi-square test for categorical variables and the independent t-test for continuous variables.

RESULTS

A total of 105 patients were added in the study with a mean age of 58.2 ± 11.8 years. Among them, 60% were male and 40% were female. Ischemic stroke was more prevalent, affecting 75.2% of patients, while hemorrhagic stroke was observed in 24.8%. The mean NIHSS score was 14.6 ± 6.1, indicating moderate to severe neurological impairment, with a mean GCS score of 10.3 ± 3.5 and an mRS score of 3.1 ± 1.5, reflecting significant disability in many patients. Regarding mobility, 70.5% of the patients were ambulatory, whereas 29.5% were non-ambulatory. Comorbidities were common, with 50.5% having hypertension, 20% having diabetes, and 20% having both conditions. The

mean postvoid residual urine volume was 127.4 ± 72.8 mL, with 55.2% of patients classified as having high postvoid residual urine volume (≥100 mL), indicating urinary retention. Normal postvoid residual urine volume (<100 mL) was observed in 44.8% of patients.

Table 1

Patient Demographics and Clinical Characteristics

Variable	N (%) or Mean ± SD
Total Patients	105
Mean Age (years)	58.2 ± 11.8
Sex (Male)	63 (60.0%)
Sex (Female)	42 (40.0%)
Stroke Type (Ischemic)	79 (75.2%)
Stroke Type (Hemorrhagic)	26 (24.8%)
Mean NIHSS Score	14.6 ± 6.1
Mean GCS Score	10.3 ± 3.5
Mean mRS Score	3.1 ± 1.5
Ambulatory Patients	74 (70.5%)
Non-Ambulatory Patients	31 (29.5%)
Hypertension	53 (50.5%)
Diabetes	21 (20.0%)
Both Hypertension and Diabetes	21 (20.0%)
No Comorbidities	10 (9.5%)
Mean PVR Volume (mL)	127.4 ± 72.8
High PVR (≥100 mL)	58 (55.2%)
Normal PVR (<100 mL)	47 (44.8%)

Postvoid residual urine volume was assessed in acute stroke patients, revealing that 58 patients (55.2%) had high postvoid residual urine volume (≥100 mL), indicating significant urinary retention. Meanwhile, 47 patients (44.8%) had normal postvoid residual urine volume (<100 mL), suggesting better bladder emptying. The high prevalence of urinary retention highlights the impact of stroke on bladder function, likely due to neurological impairment affecting detrusor muscle control.

Table 2

Postvoid Residual Urine Volume (PVR) Distribution

PVR Category	Number of Patients (N)	Percentage (%)
High PVR (≥100 mL)	58	55.2%
Normal PVR (<100 mL)	47	44.8%

Among the stroke types, ischemic stroke was more prevalent, with 60 patients (75.9%) having normal postvoid residual urine volume and 20 patients (24.1%) experiencing high postvoid residual urine volume. In hemorrhagic stroke cases, 18 patients (72%) had normal postvoid residual urine volume, while 7 patients (28%) had high postvoid residual urine volume.

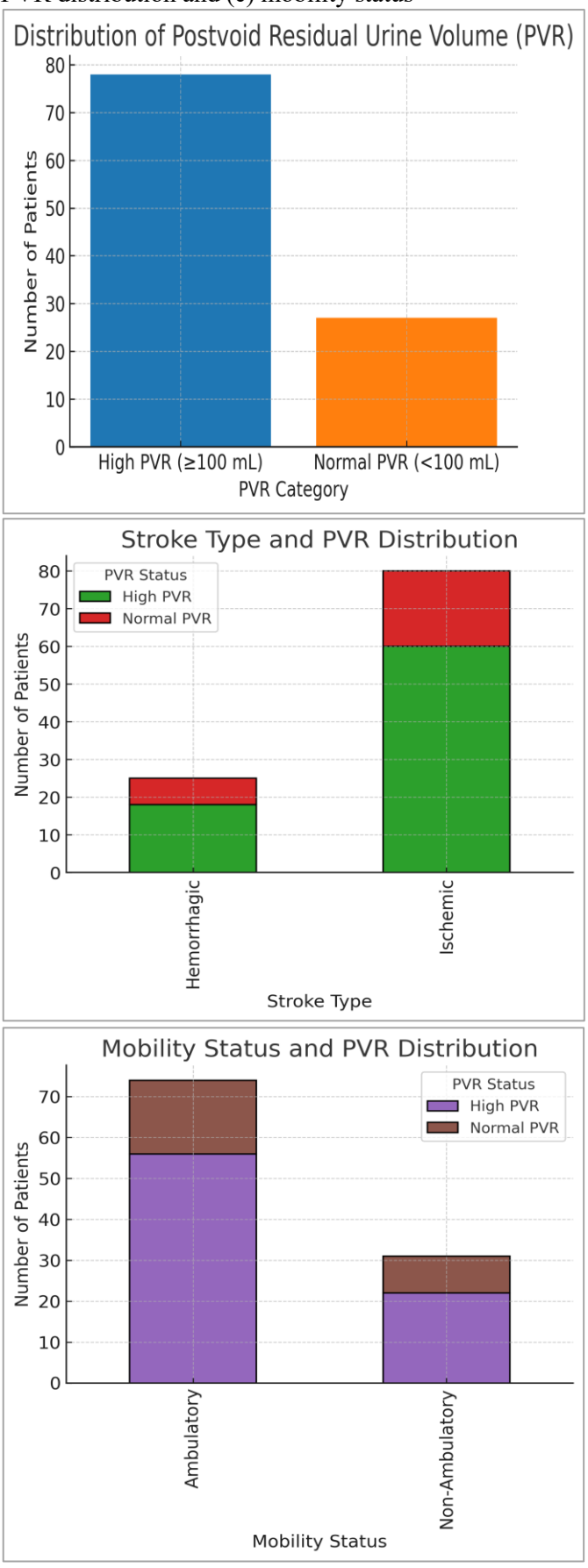
Table 3

Stroke Type and PVR Distribution

Stroke Type	Normal PVR (<100 mL) (N, %)	High PVR (≥100 mL) (N, %)
Hemorrhagic	18	7
Ischemic	60	20
Mobility Status		
Ambulatory	56	18
Non-Ambulatory	22	9

Figure 1

(a) Showing distribution of PVR, (b) stroke type and PVR distribution and (c) mobility status



DISCUSSION

This study aimed to evaluate postvoid residual urine volume in acute stroke patients and its association with stroke severity, mobility status, and comorbidities. The research results showed that high postvoid residual urine volume (≥100mL) was present in 55.2% of patients which demonstrated significant urinary retention problems in this cohort. Patients with high quantities of urine remaining in their bladder after urination face numerous complications including urinary infections as well as renal damage and significantly longer stays in hospitals unless they receive proper medical care [11]. The research demonstrated stroke severity can influence how patients measure on Postvoid Residual Urine Volume Tests. The chances of obtaining high postvoid residual urine volumes were greater among patients who displayed higher NIHSS scores and lower Glasgow Coma Scale scores [12]. The research indicates neurological impairment of greater severity results in breakdown of normal bladder control which produces incomplete bladder emptying. Patients who suffer from severe strokes develop detrusor areflexia together with detrusor-sphincter dyssynergia which cause urinary retention. Medical research prior to this study already demonstrated that severe strokes cause neurogenic bladder dysfunction [13].

The evaluation showed that mobility status influences the levels of postvoid residual urine volume. Postvoid residual urine volume remained elevated more substantially among non-ambulatory stroke patients in contrast with patients who could walk. Lower mobility coupled with a longer period spent in bed results in urinary retention because it depresses detrusor muscle performance and weakens bladder reflexes [14]. The results show that stroke patients who maintain mobility tend to experience better results than their immobile peers since mobilization together with bladder training and intermittent catheterization reduces possible complications [15]. Patients with hypertension and diabetes showed greater numbers of individuals with elevated postvoid residual urine volume according to the study. People with both diseases developed urinary retention at the greatest rate. Hypertension together with diabetes causes both autonomic nervous system dysfunction and bladder compliance reduction which leads to incomplete bladder emptying. Stroke patients who have metabolic disorders need detailed urinary function evaluations and continuous assessment [16].

Postvoid residual urine volume measurements in patients with hemorrhagic stroke rose slightly higher than in patients with ischemic stroke and yet the statistical data showed no significant difference between the groups. Brain damage extent and neurological impairments tend to be worse in patients who experience hemorrhagic stroke [17]. A bigger study population should conduct additional research to reveal the full extent of how stroke type affects urinary function. The evidence suggests healthcare providers should test stroke patients' residual urine volume by implementing standardized assessments for patients with severe symptoms and mobility issues and patients who have hypertension or diabetes [18]. Health professionals should use bladder ultrasound scanning and intermittent catheterization while teaching bladder retraining exercises as rehabilitation methods to stop urinary retention issues. Medical specialists may prescribe alpha-blockers or cholinergic agents to particular patients to enhance their bladder functioning [19-20]. The study provides major useful insights but its effectiveness is reduced by certain restrictions. The results suffered from limited generalization because the research took place at one healthcare center using a restricted patient number (105 patients). Nonetheless the study lacks follow-up data on patients after their stroke which hinders the ability to determine changes in bladder function throughout time. Longitudinal assessments of urinary dysfunction in stroke patients need more research attention alongside studies about effective treatment methods for high postvoid residual urine volume.

CONCLUSION

It is concluded that postvoid residual urine volume is significantly elevated in a substantial proportion of acute stroke patients, with more than half exhibiting urinary retention. High postvoid residual urine volume is strongly associated with greater stroke severity, reduced consciousness levels, and impaired mobility, indicating the impact of neurological deficits on bladder function. Non-ambulatory patients were found to be at a higher risk of urinary retention, emphasizing the role of physical inactivity in bladder dysfunction.

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