



The course of post-stroke bladder problems and their relation with functional and mental status and quality of life: A six-month, prospective, multicenter study

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ABSTRACT

Objectives: The aim of this study was to evaluate the frequency and course of post-stroke lower urinary tract dysfunction (LUTD) from early term up to a period of six months and to investigate the relation of LUTD with functional and mental status and quality of life (QoL) in stroke patients.

Patients and methods: This prospective study included a total of 70 stroke patients (44 males, 26 females; mean age 62.7 ± 7.0 years; range, 46 to 79 years) from five different centers across Turkey between June 2015 and January 2017. The patients were questioned using the Danish Prostatic Symptom Score (DAN-PSS) to evaluate LUTD and evaluated using the Modified Barthel Index (MBI), Incontinence QoL Questionnaire (I-QOL), and Mini-Mental State Examination (MMSE) at one, three, and six months.

Results: At least one symptom of LUTD was observed in 64 (91.4%), 58 (82.9%), and 56 (80%) of the patients according to the DAN-PSS at one, three, and six months, respectively. A statistically significant improvement was found in the DAN-PSS, MBI, MMSE, I-QOL total scores, avoidance and psychosocial subgroup scores at six months compared to the first month scores ($p < 0.05$). There was a significant negative correlation between the DAN-PSS symptom score at one month and the MBI, MMSE, and QoL scores at six months. The DAN-PSS bother and total scores were found to be significantly and negatively correlated only with the subscales of the QoL questionnaire.

Conclusion: Based on our study results, LUTD was very common and the prevalence of LUTD findings decreased constantly during six-month follow-up, showing an association with a poor cognitive and functional status and QoL in stroke patients with LUTD.

Keywords: Danish prostatic symptom score, incontinence, lower urinary tract dysfunction, stroke.

Lower urinary tract dysfunction (LUTD) is a broad term of subjective urinary tract symptoms such as nocturia, urgency, urinary incontinence (UI), and frequency of voiding, defined by the International Continence Society.^[1] Several disorders and conditions affecting the nervous system which controls the lower urinary system may result in neurogenic LUTD.^[2] Stroke is one of these conditions and it can further increase the problem of LUTD which is common in the aging population.^[3]

There is a large spectrum of post-stroke urinary symptoms varying from incontinence to retention.^[4] The prevalence varies according to the time after stroke, and at least one symptom of LUTD has been reported in 94% of patients.^[5] Urinary incontinence, which has recently been recognized as the most common of these symptoms, is noteworthy and its prevalence has been reported by various studies to range between 40 and 60%.^[4] There is a limited number of studies conducted in this topic, and patients with decreased

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incontinence after the acute period have been reported to present with different urinary symptoms such as nocturia, frequency, and urgency.^[5,6] Many authors, thus, emphasize the need to further investigate urinary symptoms, as well as post-stroke urinary incontinence.^[7,8]

Previous studies have suggested that various risk factors are associated with LUTD such as lesion size and severity, advanced age, female sex, having an underlying medical condition (such as ischemic heart disease, hypertension, and diabetes mellitus), aphasia, and depression in patients with stroke.^[9,10] Chronicity of problems related to the lower urinary system in these patients leads to infections, increases maintenance burden and risk of falling with limitations to social life, and depression. Also, LUTD may present with severe motor loss of the lower extremity.^[11,12]

Problems associated with LUTD may vary according to the course of disease, and this can significantly affect the quality of life (QoL) depending on the functional and mental status of the patient. In a recent study, it has been demonstrated that nocturia and urgency incontinence have the greatest impact on the QoL in patients with chronic stroke.^[13] The literature review reveals that there is insufficient data regarding the course of LUTD symptoms other than urinary incontinence in stroke patients and their relation with functional and mental status.

In the present study, we aimed to evaluate the frequency and course of post-stroke LUTD from early term up to a period of six months and to investigate the relation of LUTD with functional and mental status and QoL in stroke patients.

PATIENTS AND METHODS

This study was designed as a prospective and multicenter study and included a total of 70 stroke patients (44 males, 26 females; mean age 62.7 ± 7.0 years; range, 46 to 79 years) enrolled by the Neurogenic Bladder Study Group from five different centers across Turkey between June 2015 and January 2017. *Inclusion criteria were as follows:* (i) a recent (within one month) stroke in medically stable patients and (ii) being older than 18 years. *Exclusion criteria were as follows:* (i) the presence of a history of a prior cerebrovascular disease, (ii) the presence of a concurrent neurological disorder, (iii) having an acute systemic disorder or a concomitant disease which can affect urination problems, (iv) having a

history of urinary system problems before stroke, and (v) being incapable of answering questions due to any reason.

Data collection

Data including demographic and clinical characteristics of the patients including side of the stroke, cause of the stroke, stroke location, and anticholinergic drug use were obtained from the patient files and through face-to-face interviews. In addition, all patients were questioned at the post-stroke one, three, and six months in terms of post-stroke bladder drainage methods (i.e., normal spontaneous urination, use of adjunct maneuvers such as Crede, Valsalva and tapping, pad, clean intermittent catheterization, or indwelling catheter).

The patients were questioned using the Danish Prostatic Symptom Score (DAN-PSS), and evaluated using the Modified Barthel Index (MBI), Incontinence Quality of Life Questionnaire (I-QOL), and the Mini-Mental State Examination (MMSE) at one, three, and six months.

The DAN-PSS consists of 12 questions regarding the frequency of the LUTD symptoms and is used to evaluate the impact of each symptom on the QoL of the subject. Four questions are related to voiding symptoms (hesitancy, weak stream, bladder emptying, and straining), four to storage functions (frequency, nocturia, urgency, and urge incontinence), and four to miscellaneous symptoms (pain, post-micturition dribbling, stress incontinence, and 'other' incontinence). All answers are classified in a four-ranked scale from zero to three, zero being the absence of symptoms or trouble, three the maximal frequency or trouble. The total DAN-PSS-1 index was calculated as (symptom score x bother score). The validity and reliability of this questionnaire have been shown in patients with stroke.^[14,15]

The MBI is used to measure the disability experienced by the patient in performing activities of daily living. It comprises 10 items regarding activities of daily living and mobility and assesses feeding, transfer from wheelchair to bed and back, self-care, bathing, walking, climbing stairs, dressing, and bladder and bowel continence. Scoring is based on whether the patient requires help or not in performing any of the above mentioned activities.^[16]

The I-QOL is a self-administered, disease-specific instrument comprised of 22 questions (5-point Likert scale) in three main domains: avoidance behavior, psychosocial impact, and social embarrassment.

A global scale score is obtained by summing up the responses to all items and transforming the raw total score to a 0 to 100 scale (0-worst/100-best QoL).^[17]

The MMSE is a test in which the cognitive level of the patients is evaluated under five main headings (orientation, memory, attention and calculation, recall, and language). Evaluation is made on 11 items and on a total of 30 points; 24-30 points indicate normal cognitive function and less than 24 points indicate impaired cognitive function.^[18]

A written informed consent was obtained from each patient. The study protocol was approved by the Ethics Committee of Ege University Medicine Faculty (Decision number: 15-3.2/13). The study was conducted in accordance with the principles of the Declaration of Helsinki.

Statistical analysis

Statistical analyses were performed using the IBM SPSS version 22.0 software (IBM Corp., Armonk, NY, USA). Descriptive statistics were Expressed in mean ±

standard deviation (SD), median (min-max) or number and frequency. The Kolmogorov-Smirnov test was used to analyze normal distribution assumption of the data. Parametric and non-parametric tests were used for the statistical evaluation due to the distributions of evaluation parameters. The Mann-Whitney U or independent samples t-test and chi-square test were used for inter-group comparisons. The Friedman's and Wilcoxon tests were used for intra-group comparison of parameters at different time points. The correlation between the numerical variables were analyzed using the Pearson and Spearman correlation analyses. A *p* value of <0.05 was considered statistically significant.

RESULTS

Baseline demographic and clinical characteristics of the patients are presented in Table 1. Accordingly, we found that ischemia was the most common cause of stroke, with the middle cerebral artery irrigation area being the most affected.

Table 1. Baseline demographic and clinical characteristics of patients (n=70)

	n	%	Mean±SD
Age (year)			62.7±7.0
Gender			
Female	26	37.1	
Male	44	62.9	
Educational status			
Literate	54	77.1	
Occupation			
Employee	3	4.3	
Worker	12	17.1	
Retired	20	28.6	
Housewife	24	34.3	
Other	11	15.7	
Side of stroke			
Right	33	47.1	
Left	37	52.9	
Cause of stroke			
Hemorrhagic	13	18.6	
Ischemic	56	80	
Hemorrhagic + ischemic	1	1.4	
Location of stroke (MCA)	40	66.7	
Anticholinergic drug use (yes)	5	7.1	
Method of bladder emptying after stroke			
Normal	58	82.9	
Underpad	30	42.9	
Indwelling catheter	12	17.1	
Mini-Mental State Examination			
Normal	30	42.9	
Impaired	40	57.1	

SD: Standard deviation; MCA: Middle cerebral artery.

Table 2. Lower urinary tract dysfunction-related problems from during study period

	1 st month		3 rd month		6 th month		
	n	%	n	%	n	%	
LUTD prevalence							
First	Nocturia	64	91.4	58	82.9	56	80
Second	Daytime frequency	51	79.7	42	65.6	41	64.1
Third	Urgency	50	78.1	42	65.6	38	59.4
UI prevalence							
First	Nocturia	35	54.7	41	64.1	38	59.4
Prevalence of LUTDs bother							
First	Daytime frequency	52	74.3	46	65.7	40	57.1
Second	Nocturia						
Third	Urge incontinence	55.7		51.4		52.9	
	50		51.4		50		
	48.6		51.4		48.6		

LUTD: Lower urinary tract dysfunction; UI: Urinary incontinence.

According to the DAN-PSS scores, at least one symptom of LUTD was observed in 64 (91.4%), 58 (82.9%), and 56 (80%) of the patients at one, three, and six months, respectively. The most common complaints in these patients were nocturia (79.7%), daytime frequency (78.1%), and urgency (54.7%) (Table 2).

The evaluation of LUTD-related problems in the patients from one to six months demonstrated that, among the LUTD findings, daytime frequency (55.7%) was the most discomforting to the patients at one month, whereas urgency was the most discomforting to the patients at three and six months (Table 2).

The mean MBI and QoL scores at six months were found to be significantly lower in patients with LUTD (+) at one month (baseline), compared to those without LUTD. All parameters (MBI, MMSE, and QoL scores) assessed at six months were found to be significantly lower for patients with UI than those without UI at baseline (Table 3).

Table 4 shows changes in the DAN-PSS, functional, mental status and QoL scores from one to six months. Accordingly, there was a significant improvement in the bother and total scores of the DAN-PSS and MBI, MMSE, and QoL total scores at three months compared to the first-month values. In addition, there was a significant improvement in all evaluated parameters between the six-month and one-month and between the three-month and six-month values.

Table 5 shows the correlation between the first-month DAN-PSS scores and the functional, mental status, and QoL scores of patients at six months. Accordingly, there was a significant and negative correlation between the DAN-PSS symptom scores at one month and at six-month MBI, MMSE, and QoL scores. However, the r values for the MBI and MMSE were low. On the other hand, the DAN-PSS bother and total score subgroups were found to be significantly and negatively correlated only with the subscales of the QoL questionnaire.

Table 3. Differences between baseline LUTD (+) and LUTD (-)/UI (+) and UI (-) patients according to function, mental status, and QoL at six months

	LUTD (+) (n=64)	LUTD (-) (n=6)	p†	UI (+) (n=52)	UI (-) (n=18)	p‡
	Mean±SD	Mean±SD		Mean±SD	Mean±SD	
Modified Barthel Index	66.4±22.4	89.2±6.6	0.016*	64.4±23.5	79.7±14.1	0.012*
Mini-Mental State Examination	23.7±4.1	26.3±3.0	0.123	23.3±4.2	25.7±2.8	0.025*
I-QOL						
Total score	79.6±17.4	99.6±0.9	0.007*	77.8±17.6	91.4±13.4	0.004*
Avoidance behavior	75.6±21.5	99.5±1.3	0.009*	72.6±22.1	92.4±11.6	0.001*
Psychosocial impacts	75.5±22.4	100±0.0	0.010*	72.3±22.6	93.0±13.5	<0.001*
Social embarrassment	75.0±23.9	100±0.0	0.013*	72.1±24.3	91.7±15.8	0.002*

LUTD: Lower urinary tract dysfunction; UI: Urinary incontinence; SD: Standard deviation; p†: Differences between LUTD; p‡: Differences between UI; I-QOL: Incontinence Quality of Life Questionnaire; * p<0.05.

Table 4. Changes in DAN-PSS, functional, mental status, and QoL scores between one and six months

	1 st month			3 rd month			6 th month			<i>p</i>
	Mean±SD	Median	Min-Max	Mean±SD	Median	Min-Max	Mean±SD	Median	Min-Max	
DAN-PSS										
Symptom score	6	0-12		5	0-12		4*,†	0-12*,†	<0.001	
Bother score	10	0-20		8*	0-23*		7*,†	0-23*,†	<0.001	
Total score	15.5	0-46		8.5*	0-47*		10*,†	0-61*,†	<0.001	
Modified Barthel Index	44.4±27.2			58.9±24.8*			68.4±22.5*,†		<0.001	
Mini Mental State Examination	21.2±5.4			22.9±4.6*			23.9±4.0*,†		<0.001	
I-QOL										
Total score	70.7±23.3			75.7±19.7*			81.3±17.5*,†		<0.001	
Avoidance behavior	71.2±22.3			72.0±22.2			77.6±21.7*,†		<0.001	
Psychosocial impacts	72.5±23.4			72.2±23.2			77.6±22.5*,†		<0.001	
Social embarrassment	66.4±26.2			69.6±26.5			77.1±23.9*,†		<0.001	

DAN-PSS: Danish Prostatic Symptom Score; QoL: Quality of Life; I-QOL: Incontinence Quality of Life Questionnaire; SD: Standard deviation; Min: Minimum; Max: Maximum; P: Friedman's test; * Statistically significance according to 1st month, Wilcoxon signed rank test, p<0.05; † Statistically significance according to 3rd month, Wilcoxon signed rank test, p<0.05.

Table 5. Correlations between DAN-PSS scores (at one month) and, function, mental status, and QoL at six months

	6 th month MBI	6 th month MMSE	6 th month IQOL-total	6 th month IQOFL-a	6 th month IQOFL-p	6 th month IQOFL-s
	<i>p</i>	<i>p</i>	<i>p</i>	<i>p</i>	<i>p</i>	<i>p</i>
1st month						
DAN-PSS symptom score, (r)	-0.267*	-0.247*	-0.442†	-0.778†	-0.724†	-0.738†
1st month						
DAN-PSS bother score, (r)	-0.228	-0.225	-0.570‡	-0.794†	-0.751†	-0.734†
1st month						
DAN-PSS total score, (r)	-0.167	-0.212	-0.566†	-0.711†	-0.637†	-0.600†

DAN-PSS: Danish Prostatic Symptom Score; QoL: Quality of Life; MBI: Modified Barthel Index; MMSE: Mini-Mental State Examination; IQOL: Incontinence Quality of Life Questionnaire; IQOL-a: IQOL-avoidance behavior; IQOL-p: I-QOL-psychosocial impacts; I-QOL-s: I-QOL-social embarrassment; * p<0.05; † p<0.01; ‡ p<0.001.

All DAN-PSS scores were significantly higher in the patients with normal MMSE than those with poor MMSE at six months. The six-month MMSE scores were significantly lower in the patients with LUTD than those without, whereas they were significantly lower in the patients with UI than those without UI. Finally, evaluation of the bladder voiding methods demonstrated that 58 (82.9%) of the patients were able to void spontaneously at one month, while this rate increased to 64 (91.4%) at six months. With regards to the use of external collectors, the rate of underpad use at one month was 42.9%, which fell to 28.6% at six months.

DISCUSSION

In this prospective study, we investigated the frequency and course of post-stroke LUTD from early term up to a period of six months and the relation of

LUTD with functional and mental status and QoL in stroke patients. Accordingly, at least one symptom related with LUTD was observed in 64 (91.4%) of the patients at one month according to the DAN-PSS and the most common complaint in these patients was nocturia (79.7%). The symptom of LUTD which were the most discomforting to the patients was reported as daytime frequency (55.7%). At three and six months, 58 (82.9%) and 56 (80%) of the patients were reported to have at least one LUTD finding, respectively. The mean MBI and QoL scores at six months were also found to be significantly lower in the patients with LUTD compared to those without. All parameters including MBI, MMSE, and QoL scores evaluated at six months were found to be significantly lower for patients with UI than those without. In addition, a statistically significant improvement was found in the DAN-PSS, MBI, MMSE, I-QOL total scores, avoidance and psychosocial subgroup scores at six months

compared to one-month values. Accordingly, a negative correlation was found between the DAN-PSS symptom score at one-month and six-month MBI, MMSE, and QoL scores. On the other hand, the DAN-PSS bother and total score subgroups were found to be significantly and negatively correlated only with the subscales of the QoL questionnaire.

In patients with stroke, urinary retention due to decreased detrusor activity, frequent urination, nocturia, urinary urgency, and urgency-type UI due to increased detrusor activity may be seen.^[19] Lower urinary tract dysfunction is a common problem and its frequency ranges from 80 to 90%, depending on the period following stroke. However, literature studies have shown that the most frequently examined LUTD parameters include UI and urinary retention, whereas the prevalence rates of the other important LUTD complaints such as urgency, pollakiuria, nocturia have not been clearly understood, yet.^[5]

From the few studies on this subject and in the cross-sectional study conducted by Tibaek et al.^[5] involving 407 patients with stroke, LUTD was evaluated using the DAN-PSS questionnaire, similar to our study, and 94% of the patients were found to have at least one LUTD finding.^[5] The most frequent complaints were nocturia (76%), urgency (70%), and daytime frequency (59%), whereas the most discomforting of these complaints to the patients were nocturia (53%), urgency (48%), and daytime frequency (40%).

In another study, Williams et al.^[20] evaluated LUTD using a larger sample size and 83.6% of the patients were found to have ≥ 1 LUTD finding at three months with the most frequent complaints being nocturia (79.1%), UI (43.5%), and increased incontinence (17.5%). Similar to the previous studies, our study also demonstrated that LUTD continued to decrease during the six-month follow-up period in patients with stroke who were followed as of the first month. At one month, at least one LUTD finding was reported in 91% of the patients, whereas 82.9% (n=58) and 80% (n=56) of the patients were reported to have at least one LUTD finding, respectively at three and six months. The most frequent complaints were nocturia (79.7%), daytime frequency (78.1%), and urgency (54.7%) at one month and urgency (64.1%), nocturia (59.4%), and daytime frequency (59.4%) at six months.

The main goal of post-stroke management is to regain maximum functional independence with rehabilitation.^[21] As a result, it is important to develop rehabilitation programs considering factors causing

loss of function. Apart from having significant effects on sleep, daily activities, social life and relationships, LUTD has been also reported to be a predictor of poor functional status.^[22] However, studies have reported that LUTD are associated with mostly UI.^[22-24]

In a longitudinal study including 752 stroke patients, Kolominsky-Rabas et al.^[22] reported that the Barthel Index scores of those with UI after a period of 12 months were significantly lower and these patients were more confined to the home. In another study, the effect of post-stroke UI on disability was evaluated and those with persistent UI, irrespective of other factors, were associated with poor clinical outcomes, compared to those without UI (27% vs. 9%).^[23] In their study, Wade and Hewer^[24] also reported that patients with UI who were evaluated within seven days of stroke demonstrated a stronger prognostic indicator for poor functional status than those with reduced consciousness. In their study, Turhan et al.^[25] studied the influence of UI in functional recovery after stroke. The presence of UI on admission was found to be a strong negative predictor of successful rehabilitation in the entire study group ($OR=14.8$, 95% CI: 6.5-33.9) as well as in subgroups of hemorrhagic and ischemic stroke patients ($OR=25.0$, CI: 3.9-160.5 and $OR=13.9$, CI: 5.4-35.5, respectively), and in patients with cortical and subcortical lesions ($OR=30.2$, CI: 7.2-126.7 and $OR=9.3$, CI: 2.7-31.4, respectively). The authors showed that evidence of UI was a strong negative predictor for stroke rehabilitation outcome in all age groups.

Considering the relation of UI with poor functional status, some authors have suggested that the ability of patients to participate in rehabilitation programs was negatively affected mainly due to physical and psychological disadvantages. The daily activities of patients can be affected through the creation of a sense of fear, embarrassment, and guilt, and a low morale and self-esteem may lead to poor concentration, apathy, and ultimately a decrease in the desire to participate in the rehabilitation program.^[26] In addition, UI is also an indication of the severity of stroke and is independently associated with falling, urinary tract infections, skin injuries, and prolonged hospitalization.^[26]

In our study, there was a weak but significant negative correlation between the one-month DAN-PSS symptom scores and the six-month MBI scores. We also found that the MBI scores of the patients with baseline LUTD at one month were significantly lower than that of those without LUTD, while MBI values at one month were significantly lower in the patients with baseline UI than in those without UI.

Furthermore, LUTD causes a significant decrease in the QoL by adversely affecting the lives of the patients in every aspect.^[13] Those who experience this problem may feel themselves like defective and incomplete, as they are unable to control their urinary function, while problems such as bad odor, poor hygiene, and skin irritation may lead to impaired body image and social isolation. Individuals with UI are also faced with certain limitations in their physical and social due to these problems. Previous studies have shown that UI is also associated with impaired QoL. Edwards et al.^[12] reported that patients with ≥1 complaint of UI per month had reduced QoL and decreased participation in activities. Another recent study showed that nocturia and UI were the most common LUTD symptoms which adversely affected QoL in patients with chronic stroke (for a mean duration of eight years).^[13]

Evaluation of the QoL of our patients by the I-QOL questionnaire demonstrated that the scores of all subscales of the I-QOL questionnaire at six months were significantly lower at baseline in patients with UI or LUTD compared to those without UI or LUTD. Correlations were also higher between lower urinary tract symptoms and QoL (DAN-PSS scores and I-QOL) than for lower urinary tract symptoms and MBI and MMSE. It is reasonable to find a favorable relationship between a questionnaire which measures symptoms and bother and QoL of the same nature (urinary symptoms).

Although cognitive impairment is common in patients with stroke, data regarding its relationship with LUTS is scarce. In this study, the patients who were evaluated with the MMSE scores demonstrated that all DAN-PSS scores were significantly higher in those with normal MMSE than those with poor MMSE at six months. In addition, the MMSE scores were significantly lower in the patients with LUTD than in those without at six months, whereas these scores were significantly lower in the patients with UI than in those without. On the other hand, there was no significant difference in cognitive functions between the patients with and without LUTD at one month and six months. However, this difference was statistically significant between the patients with and without UI and this factor is probably more important for predicting future cognitive impairment in stroke patients. This finding is also consistent with the result of the study conducted by Pizzi et al.^[27] These authors evaluated cognitive functions using communication and social awareness items of the Functional Independence Measure scores and they demonstrated that cognitive impairment was higher in the patients with UI than in those without

(both at baseline and on Day 30). In another study, the patients with UI had significantly lower scores on the cognitive test scale than those in the continent group and that these patients presented with more memory and retention impairment.^[28]

Nonetheless, the main limitation of the present study is that the DAN-PSS questionnaire is a self-reported instrument and the data about the prevalence were not based on medical records. Thus, the actual prevalence of LUTD after stroke may be underestimated. Despite this limitation, the study design is multicentric and all participants completed the six-month follow-up period.

In conclusion, our study results demonstrated that LUTD was very common and that the prevalence of LUTD findings decreased constantly during the six-month follow-up period. These findings were also associated with a poor cognitive, functional status, and QoL in stroke patients with LUTD. Based on these results, we suggest that bladder dysfunction and its consequences should not be ignored during rehabilitation of patients with stroke and that long-term care should be provided to these patients under close monitoring of their complaints.

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