

# Urinary tract infections in a group of post-stroke patients – a preliminary report

## Zakażenia układu moczowego u pacjentów po udarze mózgu – doniesienie wstępne

Mariola E. Wodzińska<sup>1(A,D,E)</sup>, Agnieszka Doryńska<sup>2(C,D)</sup>, Beata Stach<sup>1(B,E)</sup>, Aleksandra Bober<sup>1(B,F)</sup>, Wojciech Kurzydło<sup>1(B,F)</sup>, Arkadiusz Hopek<sup>1(B,F)</sup>, Andrzej Pająk<sup>2(A,C,D)</sup>

<sup>1</sup> Neurological Rehabilitation Department, Rehabilitation Center (Centre) „Krzyszowice”, Poland

<sup>2</sup> Epidemiology and Population Studies Department, Institute of Public Health, Jagiellonian University Medical College, Poland

### Key words

stroke, complications, urinary tract infections, rehabilitation

### Abstract

**Introduction:** The incidence, etiopathogenesis, health consequences and costs of treatment indicate that strokes are a very important problem in public health nowadays. Although some progress in the treatment of strokes has been made, the importance of the problem is still increasing. Apart from neurological deficits, as well as cognitive and intellectual impairment, urinary tract infection is one of the most common stroke-related complications to be diagnosed and treated in rehabilitation wards.

**Aim:** The study of the frequency of urinary tract infections and the relationship between urinary tract infection and socio-demographic characteristics and health.

**Material and methods:** The study covered the medical documentation of all patients hospitalized in the ward after a stroke from 01.01.2012 until 31.12.2012. This constituting a retrospective analysis of the medical documentation of 97 patients.

**Results:** We demonstrated an association between urinary tract infections and age (OR=3.77; 95%CI: 1.58-9.00), sex (OR=4.82; 95%CI: 1.85-12.57), length of time after a stroke (OR=3.75; 95%CI: 1.43-9.86), and diabetes (OR=3.07; 95%CI: 1.15-8.17). Urinary tract infection occurred in all of the patients with permanent urinary catheterization. There was no relationship between urinary tract infection and the type, location and number of strokes. Hypertension and aphasia also were not related to urinary tract infection.

**Conclusions:** 1. The permanent insertion of a catheter in post-stroke patients in all cases results in urinary tract infection. It follows therefore to relieve the patient as quickly as possible of the catheter. It does not follow to routinely catheterize patients with urinary incontinence. 2. The factors resulting in a predisposition for infection of the urinary tract are: advanced age, being female as well as a short time lapse following the stroke. These individuals require especial care on the part of medical personnel.

### Słowa kluczowe

udar mózgu, powikłania, zakażenia układu moczowego, rehabilitacja

### Streszczenie

**Wstęp:** Udar mózgu ze względu na zapadalność, etiopatogenezę, poważne skutki zdrowotne oraz koszty leczenia stanowi istotny problem medyczny na świecie. Oprócz deficytów neurologicznych, zaburzeń poznawczych i intelektualnych, problemem są także powikłania udaru mózgu, do których należy zakażenie układu moczowego. Zakażenia układu moczowego są stwierdzane i leczone w oddziałach rehabilitacji stanowiąc jedną z najczęstszych komplikacji po udarze.

**Cel:** W Oddziale Rehabilitacji Neurologicznej ORNR „Krzyszowice” przeprowadzono badanie mające na celu analizę częstości występowania zakażeń układu moczowego u pacjentów po udarze oraz związku tych infekcji z cechami społeczno-demograficznymi i stanem zdrowia.

**Materiał i metody:** Przeprowadzono analizę retrospektywną dokumentacji medycznej wszystkich pacjentów rehabilitowanych w Oddziale Rehabilitacji Neurologicznej w roku 2012. Badanie objęło 97 pacjentów.

**Wyniki:** Przeprowadzone badanie wskazuje na zależność pomiędzy infekcją układu moczowego a wiekiem (OR=3,77; 95%CI: 1,58-9,00), płcią (OR=4,82; 95%CI: 1,85-12,57), czasem, jaki upłynął od udaru (OR=3,75; 95%CI: 1,43-9,86) oraz cukrzycą (OR=3,07; 95%CI: 1,15-8,17). U wszystkich pacjentów, którzy mieli założony na stałe cewnik rozwinęła się infekcja układu moczowego. Nie stwierdzono istotnej zależności pomiędzy typem, lokalizacją i liczbą przebytych udarów oraz występowaniem nadciśnienia tętniczego i afazją a zakażeniem układu moczowego.

The individual division on this paper was as follows: A – research work project; B – data collection; C – statistical analysis; D – data interpretation; E – manuscript compilation; F – publication search

Article received: 25.04.2013; accepted: 05.06.2013

Wnioski: 1. Założenie cewnika moczowego na stałe u chorych po udarze mózgu we wszystkich przypadkach prowadzi do infekcji układu moczowego. Należy zatem dążyć do jak najszybszego uwolnienia pacjenta od cewnika. Nie należy rutynowo cewnikować pacjentów z nietrzymaniem moczu. 2. Czynniki predysponującymi do infekcji układu moczowego u chorych po udarze są: starszy wiek, płeć żeńska oraz krótszy czas, jaki upłynął od udaru mózgu. Osoby te wymagają szczególnej uwagi ze strony personelu.

## INTRODUCTION

Strokes are one of the chief causes of illness and death in the world<sup>1</sup>. The high incidence, varied causes and health consequences, and in addition the cost of treatment means that strokes are at present a significant problem.

It is the third, after heart diseases and cancers, most frequent cause of death as well as being the most often cause of disability in the population over the age of 40<sup>2,3</sup>. Strokes are also the second most frequent cause of dementia, the most often cause of epilepsy in the elderly as well as a common cause of depression<sup>1</sup>. There are registered annually in Poland around 60 thousand new cases with about 40,000 people surviving strokes<sup>2</sup>.

According to data published in 2003 in the Internet under the auspices of the National Consultant for the field of neurology, the coefficients of incidence in Poland are: 177 for every one hundred thousand men and 125 for every one hundred thousand women and is maintained at the average European level<sup>4</sup>. However, taking into consideration the mortality rate connected with strokes, its rates in Poland are among the highest in Europe and in a similar way to other countries of Eastern Europe they display an upward tendency. The coefficient for mortality in Poland is 106 for every 100,000 men and 79 for every 100,000 women<sup>5</sup>. Similarly unfavourable in Poland is the coefficient of invalidity amongst stroke patients. In Poland this is 70%, while in well developed countries it is only around 50%<sup>4</sup>. Despite improvements in treatment the significance of this health problem continually rises. Regardless of the level of development and industrialization as well as the value of the GDP of a given country, strokes are a significant social problem<sup>6</sup>. Besides it is noted that the level of incidence of vascular diseases of the cen-

tral nervous system is comparable to the level in the incidence of heart attacks, while an aging population merely accentuates this<sup>7</sup>.

A stroke results in neurological deficiencies of various kinds that limit mobility, disturb cognitive, intellectual, and emotional processes. 25-50% of stroke patients are dependent on the help of others in their surroundings in daily activities, as a result of partial or total disability<sup>8,9,10</sup>. A problem is also their consequences and complications, which impose themselves upon the already existing neurological deficiencies and constitute a treatment problem, reducing the quality of life. Complications affect from 56% to 96% of patients undergoing rehabilitation following a stroke<sup>11</sup>. Later problems after a stroke may make the process of rehabilitation more difficult and reduce its effectiveness. Some of them, not diagnosed in time and untreated, may be a threat to life itself. These include infection of the urinary tract. These are one of the most common complications of a severe stroke, occurring in 3 to 44% of stroke patients<sup>12</sup>.

### Research aim

The aim of the research was to analyse the frequency in the incidence of infections of the urinary tract in stroke patients as well as the connection of these infections with socio-demographic features and the state of health.

### Materials and methods

The data was obtained from the medical documentation of all patients subjected to rehabilitation at the ORNR 'Krzeszowice' Neurological Rehabilitation Clinic as a result of strokes for the period from 01.01.2012 to 31.12.2012. In total the documentation of 97 patient was taken into consideration.

The presence of infection was established in accordance with the crite-

ria of the Centre for Disease Control (CDC Atlanta 2008)<sup>13</sup>. In the case of our own research, after taking into consideration the diagnostic methods used, urinary tract infection was confirmed when at least one of the following symptoms occurred: a temperature (over 38°C), urgency, increased frequency in urinating, dysuria, or tenderness in the suprapubic region as well as the fulfilling of at least one of the following criteria: pyuria (three or more WBC in the field of vision in non-centrifugated urine or 10 or more WBC in one ml), a doctor would diagnose urine tract infection, a doctor would start treatment as a result of urine tract infection. As a patient with a permanently installed catheter was considered every patient in whom a catheter had been fitted during registration at the Department of Neurological Rehabilitation and who was kept in for at least 7 days. The stroke diagnosis, its type and localisation was taken on the basis of diagnoses carried out at the institute or department in which the patient was treated for the stroke (anaesthesiology or intensive therapy, neurology, neurosurgical ward or clinic). Information about the number of past strokes was obtained from the patient's medical records. The appearance of aphasia was confirmed on the basis of the examination by a ward neurologist from the ward where the patient was treated for the stroke as well as on the basis of consultation with a neuro-speech therapist employed at the Department of Neurological Rehabilitation. The presence of high blood pressure was confirmed on the basis of blood pressure readings higher than 140/90 mmHg or in patients taking hypertension drugs as a result of an earlier diagnosis of high blood pressure. Diabetes was confirmed on the diagnosis and treatment received by the patient in the ward or neurological rehabilitation department where treatment for the stroke had

occurred, where the incidental blood glucose level was higher or equal to 200 mg% or where fasting blood glucose level had twice exceeded 126 mg%, in accordance with the directives of the Polish Diabetic Society of 2012.<sup>14</sup>

Analysis of the data was conducted by means of the statistical programmes PQStat ver. 1.2.2.324 and Stata ver. 11.2. An evaluation of the connection between the occurrence of urinary tract infection and the tested variables was conducted using a  $\chi^2$  test as well as by a single or multiple factor logistic regression. The level of significance was adopted at  $\chi=0.05$ . The results were presented in percentages as well as the quotient of the chances with 95% confidence interval. Factors significantly connected with the appearance of tract infection qualified themselves to the model of multifactorial logistic regression.

## RESULTS

97 patients took part in the research, of whom 71 (73.2%) were men and 26 (26.8%) women aged 35 to 88. In Table 1 the characteristics of the tested group are presented. 52.1% were patients under 65 years of age. 93.8% of patients lived with someone close. Urinary tract infection occurred in 37 (38.1%) of the patients tested. 85 patients (87.6%) had suffered an ischaemic stroke, while 12 (12.4%) – a haemorrhagic stroke. The localisation of the stroke was left-sided in 45.4% of those tested, and right-sided in 54.6%. 13.4% of those tested had suffered 2 or more strokes. 63.9% of patients had been taken into a rehabilitation centre during a period of up to 30 days since ward discharge, where the patient had been treated. High blood pressure was noted in 67.0%, while diabetes in 22.7% of the patients. Aphasia was noted in 15.5%. 7.2% of patients had a catheter permanently fitted.

In Table 2 the frequency in the incidence of urinary tract infection is presented, given in categories of age, sex, number of co-inhabitants, in categories concerning the stroke, high blood pressure, diabetes, aphasia as well as the presence of a catheter. Infections occurred significantly statisti-

cally more often in: older individuals, over 65 years old when compared to a younger age group i.e., individuals under the age of 65 (54.5% vs. 24%,  $p=0.002$ ), in women in comparison to men (65.4% vs. 28.2%,  $p=0.002$ ) as well as in patients admitted under 30 days from discharge from the ward in which these individuals had been treated for a stroke in comparison to individuals admitted after 30 days or over from discharge (48.4% vs. 20%,  $p=0.011$ ). In addition infection of the urinary tract was more frequent in individuals suffering from diabetes when compared to those without diabetes (59.1% vs. 32.0%,  $p=0.040$ ). In all those who used a catheter, infec-

tion of the urinary tract was confirmed, while in those without a catheter it was noted in 33.3% of patients ( $p=0.001$ ). No significant connection between the occurrence of urinary tract infection and the number of co-inhabitants, the type of stroke, the localisation of the stroke, the number of strokes, high blood pressure or aphasia was confirmed.

In Table 3 are presented the raw values of the quotient of the chances for the occurrence of urinary infection in the categories of age, sex, number of co-inhabitants, in the categories of strokes, high blood pressure, diabetes, aphasia and the presence of a catheter. Patients in the older age group had

Table 1

Odds ratios of urinary tract infections in the analysed categories			
		n	%
Age	≤65	50	52,1
	>65	46	47,9
Sex	female	26	26,8
	male	71	73,2
Number of co-inhabitants	1 or more	91	93,8
	0	6	6,2
Urinary tract infection	present	37	38,1
	not present	60	61,9
Stroke type	ischaemic	85	87,6
	haemorrhagic	12	12,4
Stroke localisation	left-sided	44	45,4
	right-sided	53	54,6
Number of strokes	1	84	86,6
	2 or more	13	13,4
Time from ward discharge in which stroke treatment occurred	up to 30 days	62	63,9
	over 30 days	35	36,1
High blood pressure	present	65	67,0
	not present	32	33,0
Diabetes	present	22	22,7
	not present	75	77,3
Aphasia	present	15	15,5
	not present	82	84,5
Catheter	fitted before admittance and kept after admittance to a rehabilitation ward	7	7,2
	not fitted or removed prior to admittance	90	92,8

a significantly greater chance of urinary tract infection when compared to the younger age group (OR=3.77; 95%CI: 1.58-9.00). In women when compared to men there was ascertained a significantly greater chance of urinary tract infection (OR=4.82; 95%CI: 1.85-12.57). A shorted discharge period from the place of stroke treatment was significantly linked with an increased chance of urinary tract infection (OR=3.75; 95%CI: 1.43-9.86). Diabetes was significantly connected with an increased chance of urinary tract infection (OR=3.07; 95%CI: 1.15-8.17).

In Table 4 the values of the chance quotient for the occurrence of urinary tract infection in the analysis of multifactorial logistic regression are presented. After taking into consideration the effect of sex, diabetes as well as discharge time from a stroke ward, those individuals over the age of 65 had a more than four times greater likelihood of urinary tract infection when compared to the younger patients (OR=4.23; 95%CI: 1.52-11.74). After taking into consideration the effect of age, diabetes as well as discharge time from a stroke ward, women in comparison to men were almost six fold more likely to develop urinary tract infection (OR=5.75; 95% CI: 1.86-17.76). After taking into consideration the effect of sex, diabetes and age a shorter discharge time from a stroke ward and admittance to a rehabilitation unit was linked to an almost four fold increase in the likelihood of urinary tract infection (OR=4.47; 95%CI: 1.48-13.50). After taking into consideration the effect of age, sex, as well as discharge time from a stroke ward, the link between diabetes and the occurrence of urinary tract infection turned out to be insignificant.

## DISCUSSION

The analyses conducted showed that those factors likely to cause for an increase in the occurrence of urinary tract infection include: old age, being female, a short time after ward discharge, and the presence of a catheter. The results of our research confirm the results of the tests hitherto conducted in Poland and abroad. The fre-

**Table 2**

Prevalence of urinary tract infections in the analysed categories				
		n	%	p
Age	≤65	12	24.0	<b>0.002</b>
	>65	25	54.4	
Sex	female	17	65.4	<b>0.002</b>
	male	20	28.2	
Number of co-inhabitants	1 or more	34	37.4	<b>0.855</b>
	0	3	50.0	
Stroke type	ischaemic	30	35.3	<b>0.222</b>
	haemorrhagic	7	58.3	
Stroke localisation	left-sided	21	47.7	<b>0.077</b>
	right-sided	16	30.2	
Number of strokes	1	34	40.5	0.371
	2 or more	3	23.1	
Time from ward discharge in which stroke treatment occurred	up to 30 days	30	48.4	<b>0.011</b>
	more than 30 days	7	20.0	
High blood pressure	present	27	41.5	0.327
	not present	10	31.3	
Diabetes	present	13	59.1	<b>0.040</b>
	not present	24	32.0	
Aphasia	present	8	53.3	0.304
	not present	29	35.4	
Catheter	before admittance and kept after admittance to a rehabilitation ward	7	100.0	<b>0.001</b>
	not fitted or removed prior to admittance	30	33.3	

**Table 3**

Crude odds ratios of urinary tract infections in the analysed categories		
	OR	95% CI
Age (ref. under 65)	3.77	1.58-9.00
Sex (ref. male)	4.82	1.85-12.57
Number of co-inhabitants (ref. 0)	0.60	0.11-3.12
Ischaemic stroke type (ref. haemorrhagic stroke)	0.39	0.11-1.33
Left-sided stroke localisation	2.11	0.92-4.86
Number of strokes (ref. 2 or more)	2.27	0.58-8.84
Time from ward discharge in which stroke treatment occurred (ref. over 30 days)	3.75	1.43-9.86
High blood pressure (ref. not present)	1.56	0.64-3.83
Diabetes (ref. not present)	3.07	1.15-8.17
Aphasia (ref. not present)	2.09	0.69-6.34

quency with which infections of the urinary tract occur in stroke patients is most varied, covering the range of 3% to 44 %<sup>12</sup>. In our research this frequency was 38.1%. In the research conducted by Kwolek et al.<sup>15</sup> infection of the urinary tract occurred in 19% patients up to 12 weeks following the stroke and in 12% of patients over twelve weeks after the stroke occurred.

In the present research urinary tract infection was confirmed in 54.4% of individuals over the age of 65 and in 24% of those under 65. In the research carried out by Ersoz et al.<sup>16</sup> infection of the urinary tract occurred in 54.0% of patients over 65 years old and in 19.6% of patients under 65.

In the present study urinary tract infections were confirmed more often in women (65.4%) than in men (28.2%). Similar results were obtained by Westendorp et al.<sup>17</sup>.

Urinary tract infections occurred more often during the early post-stroke phase i.e., up to 30 days from ward discharge during the acute phase. These infections are brought about by post-stroke immunosuppression, dysfunctioning of the urinary bladder, the presence of a urinary catheter, immobility, a reduced supply of fluids. Patients after a stroke had an increased risk of infection in comparison to other patients<sup>18</sup>. A key role is played out by phenomenon of post-stroke suppression, which is a factor leading to post-stroke bacterial infection. T lymphopenia, a fall in the immunological cellular response and increased activeness in the sympathetic system following a stroke is linked to a higher risk of infection<sup>12</sup>. Injuries to the brain may initiate a ge-

neral and localised inflammatory process, proof of which is the increase in extra-inflammatory cytokinins following a stroke<sup>19</sup>.

In the present research it has been ascertained that diabetes is a risk factor in urinary tract infection, however taking into consideration the effect of age, sex and the time period that elapses after the stroke this result turned out to be statistically insignificant. In stroke patients for whom the blood glucose level is as a rule controlled during hospitalisation or in a short period following hospitalisation the connection between the joint appearance of diabetes and urinary tract infection is weaker.

More frequent urinary tract infection in older individuals has various causes resulting from limitations connected with age, e.g., non-retention of urine, difficulties in maintaining hygiene. In older women there often occurs a reduction in the bladder size while in older men prostrate growth or urolithiasis constituting an obstacle for the outflow of urine.

Stott et al.<sup>12</sup>, have claimed that the factors increasing the risk of urinary tract infection in stroke patients are: the severity of the stroke, the presence of a urinary catheter, and advanced age. We confirmed in our research that significant factors are the presence of a catheter and advanced age, though also being female, a short time after stroke ward discharge, and diabetes.

In the earlier period following a stroke infections are connected with urine retention and the need to fit a catheter to the urinary bladder, while later they accompany disturbances in urinating, chiefly dysfunctions in the

urinary bladder. Non-retention and retention of urine is common following a stroke and occurs in 29% to 58% of patients<sup>18</sup>. Aphasia, cognitive disturbances and other functional disturbances are additionally connected with urinary bladder dysfunction. In around 50% of stroke patients there appears a lack of control of the urinary bladder sphincter. After 6 months following the stroke this lack of sphincter control occurs in 20% of patients. Hence there occurs the need to fit a urinary catheter, which increases the risk of infection, for the cause of the majority of urinary tract infections is the inserting of a catheter into the urinary bladder<sup>1</sup>. In the general patient population the risk of urinary tract infection increases from 3% to 10% after the first day of fitting a catheter to 100% after 30 days<sup>18</sup>.

As a result of the confirmed high frequency of urinary tract infections in individuals with a fitted catheter it follows to remove the catheter as quickly as possible from the patient. It does not follow to routinely apply catheters to patients suffering from non-retention of urine<sup>20</sup>. This is the recommendation of the Expert Team of the Polish Neurological Society.

Infections of the urinary tract are enhanced in addition by immobility, small fluid intake and low diuresis<sup>15</sup>. Risk factors also include advanced age as well as the accompanying ailments. The consequences of urinary tract infections are: prolonged stays in hospital, increased costs for hospital care, exposure to intravenous antibiotic treatment, as well as bacteria growth, and besides fever accompanying the infections and the presence of a catheter hampering the process of rehabilitation<sup>18</sup>.

There has been shown the connection between the appearance of urinary tract infection and old age, being female, a short discharge period, diabetes and the presence of a catheter. Despite the significant link between the appearance of infection in the urinary tract, having taken in to consideration the effect of age, sex and the discharge period, diabetes turned out to be a weak predictor of infection. As a rule the coexistence of diabetes increases the risk of urinary tract infection, however given that the mani-

Table 4

Crude odds ratios of urinary tract infections in the analysed categories		
	OR	95% CI
Age: over 65	4.23	1.52-11.74
Sex: female	5.75	1.86-17.76
Diabetes: present	2.41	0.73-7.95
Time from ward discharge in which stroke treatment occurred: up to 30 days	4.47	1.48-13.50

festation of diabetes is strongly linked to age, the connection of diabetes with age turned out to be stronger.

## CONCLUSIONS

1. The permanent fitting of a catheter in stroke patients in all cases results in urinary tract infection. It follows as a consequence to free the patient from the catheter as quickly as possible. It does not follow to routinely fit catheters to patients with a non-retention of urine.
2. The factors predisposing to urinary tract infection in stroke patients are: old age, being female as well as a short ward discharge time after the stroke. These individual need to be especially observed by medical personnel.

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## Address for correspondence

Mariola Wodzińska MD  
ul. Pietrusińskiego 10e, 30-321 Kraków, Poland  
phone: +48-695-240-986  
e-mail: mariolawodzinska@interia.pl

*Translated from the Polish by Guy Torr MA*