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Urinary symptoms and natural history of urinary continence after first-ever stroke—a longitudinal population-based study

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Abstract

Background: there are limited population-based data on urinary symptoms and the natural history of urinary incontinence after a first stroke.
Aim: to study the prevalence of urinary symptoms, and the natural history and factors associated with urinary incontinence after first-ever stroke.
Methods: we administered a standardised urinary symptom questionnaire at 3 and 12 months after stroke to patients enrolled in the North-East Melbourne Stroke Incidence Study. Urinary symptoms and evolution of urinary incontinence were recorded. Logistic regression was used to model associations between baseline factors and incontinence at 12 months.
Results: more than 80% of survivors reported one or more abnormal urinary symptoms at 3 or 12 months, with nocturia most frequent. Incontinence was present in 43.5% of patients at 3 months, and 37.7% at 12 months, with urge incontinence being most common. Pre-stroke continence ($P < 0.001$) and female sex ($P < 0.001$) were independently associated with incontinence at 12 months, whereas the effect of greater stroke severity was magnified with advancing age (P for interaction = 0.05).
Conclusion: the majority of survivors reported abnormal urinary symptoms early and late after stroke. Around a third of patients had incontinence at 12 months, with pre-stroke UI, age, female sex and stroke severity predicting its presence.

Keywords: *stroke, UI, urinary incontinence, natural history, urinary symptoms, elderly*

Introduction

Urinary incontinence after stroke is associated with poorer quality of life [1], higher mortality and greater disability [2]. The prevalence of urinary incontinence early after stroke varies considerably from 41 [3] to 83% [4], with most previous work being conducted in hospital-based samples. Prevalence estimates of other urinary symptoms that may also be important to patients, such as urgency, difficulty voiding and daytime and night time frequency, have only been provided in hospital-based samples [5, 6]. Such studies may be biased towards people with more severe strokes. In the handful of published population-based studies, the prevalence of urinary incontinence 4 weeks after stroke ranged from 48 [7] to 53% [8], and 32% at 1-year after stroke [8]. In the same samples, the frequency of new urinary incontinence after stroke ranged from 36 [8] to 40% [2] at 4 weeks, 19% at 3 months [2] and 24% at 1 year [8]. However, there are no data provided from these studies on the type of urinary incontinence (stress or urge) and their relative importance. Finally, there are no data describing the natural history of stress and urge urinary incontinence.

Aim

We aimed to study the prevalence of a range of urinary symptoms, the natural history of urinary incontinence and factors associated with urinary incontinence at 1-year after a first-ever stroke in a prospective population-based study.

Methods

Case ascertainment

This was a substudy nested within the North East MElbourne Stroke Incidence Study (NEMESIS), a prospective population-based incidence study of stroke. The primary objective of NEMESIS was to record all first-ever strokes occurring between 1 May 1997 and 30 April 1999 within a defined 22 postcode area (population of 306,631) of north-east Melbourne. The study methods have previously been described [9]. Briefly, all cases of stroke admitted during the study period to public and private hospitals in the area were identified using 'hot' and 'cold' pursuit and multiple overlapping sources. These included admission and discharge lists, radiology lists and regular contact with stroke physicians. Non-routine sources were also used including general practitioners, residential aged care facilities and death certificate data. A panel of stroke physicians and an epidemiologist reviewed potential cases to determine inclusion. Cases were defined according to the World Health Organization (WHO) as 'rapidly developing clinical signs of focal (or global) disturbance of cerebral function lasting more than 24 h (unless interrupted by surgery or death) with no apparent cause other than of vascular origin' [10]. A first-ever stroke was defined as an event that occurred in a patient who had no history of a prior stroke [11]. Patients with subarachnoid haemorrhage were excluded from this substudy.

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Urinary symptoms

Urinary symptoms were defined according to the International Continence Society criteria relevant at the time of study [12] as follows: urinary incontinence, 'any involuntary leakage of urine'; stress urinary incontinence, 'involuntary leakage on effort or exertion or on sneezing or coughing'; urge urinary incontinence, 'involuntary leakage (of urine) accompanied by or immediately preceded by urgency'; increased daytime frequency, 'voiding too often by day'; nocturia, 'waking at night one or more times to void' and urgency, 'a sudden compelling desire to pass urine which is difficult to defer'. In a later revision of International Continence Society criteria 'urge' urinary incontinence was replaced by the term 'urgency incontinence'.[13] The presence of these complaints was recorded using a standardised Urinary Symptoms Questionnaire previously validated against physician diagnosis with kappa scores ranging from 0.40 to 0.74 for a range of symptoms (unpublished data). The questionnaire was administered by trained study nurses, and if the patient was unable to respond, the next-of-kin served as a proxy respondent. Multiple attempts were made to contact eligible patients if they were initially unavailable or if busy at a later convenient time. The presence of pre-stroke urinary incontinence was determined indirectly from a question 'How long has urine leakage been a problem?' and was considered present if this length of time exceeded the interval between the stroke and the time of administration of the Urinary Symptoms Questionnaire. The questionnaire was introduced from 3 October 1997, after the commencement of the NEMESIS study.

Other measurements

Demographic, medical history and clinical details were collected at baseline. Sources of data included medical records and, wherever possible, the patients themselves. If the patient was unable to be interviewed, then the best available informant, usually the next of kin or a professional carer, was sought as a proxy. Stroke type was classified as either ischaemic or intracerebral haemorrhage using neuroimaging, and undetermined when these were not available [14]. Ischaemic stroke subtypes were defined according to the Oxfordshire Community Stroke Project (OCSP) criteria as Posterior Circulation Infarct (POCI), lacunar Infarct (LACI), Total Anterior Circulation Infarct (TACI) and

Partial Anterior Circulation Infarct (PACI) [15]. Using data extracted from medical records, loss of consciousness at stroke onset, dense hemiplegia and dysphasia were used as clinical indicators of stroke severity, as in a previous NEMESIS substudy of cognitive impairment [16]. The patient was categorised as having a severe stroke if two or more of these features were present; as moderate if only one was present and as mild if none was present.

Follow-up

The Urinary Symptoms Questionnaire was administered at 3 and 12 months after stroke. The National Death Index was used to determine whether patients lost to follow-up had died. Medical records and death certificates were reviewed to determine the timing and cause of death [9].

Ethics

Ethics approval was granted by all participating hospitals and institutions. Informed consent was obtained before interview from participants, or from the proxy.

Analysis

Comparison of characteristics between Urinary Symptoms Questionnaire respondents and non-respondents was performed using a *t*-test for continuous variables and Chi-squared test for categorical variables. Prevalence and incidence proportions for urinary incontinence were calculated among survivors at 3 and 12 months after stroke. Among those who completed the questionnaire at both time points, tabulation was used to examine the natural history of urinary incontinence relative to pre-stroke urinary incontinence. Univariable and multivariable logistic regression was used to describe the relationship between baseline clinical factors (age, sex, pre-stroke incontinence, stroke severity) and the urinary incontinence status (outcome variable) at 12 months after stroke. Potential two-way interactions were tested among the covariates included in the model. The analyses were performed using Stata/SE 10.0 for Windows (StataCorp, TX, USA).

Results

Of 1,589 stroke patients ascertained during the study period, 1,248 had suffered a first-ever stroke. Of these, 338 died prior to 3 months and a further 105 before 12 months. Overall response rates (number of respondents/all survivors of first-ever stroke in study period) to the Urinary Symptoms Questionnaire were 33% (299/910) at 3 months, 42% (340/805) at 12 months and 30% (243/805) at both time periods. (please see the figure in Supplementary data available in *Age and Ageing* online, Appendix 1). However, the participation rates (number of respondents/actual number approached) were much better (299/682, 44% for 3 month data, and 340/577, 59% for 12 month data), considering that the questionnaire administration began after the commencement of NEMESIS, and not all of the target population were able to be approached. Of the respondents, five patients at 3 months and 8 at 12 months, using an indwelling urinary catheter were excluded from these analyses. The comparison between responders and first-ever stroke cases not included in this substudy at 3 and 12 months demonstrated no significant differences in age, disability and stroke severity, with a slight preponderance of males among responders ($P = 0.18$) (results for 12 month comparison presented in Table 1). The proportion of people with undetermined strokes ($P = 0.03$) was greater among those not included in this study. However, among the undetermined strokes, the distribution of stroke severity was similar between responders and those not included (P for trend 0.55). The number of interval deaths between 3 and 12 months was lower among responders (5.0%) than those not included in the study (14.7%), $P < 0.01$. The number of participants that responded by proxy was 14.7% (44/299) at 3 months and 12.9% (44/340) at 12 months.

More than 80% of patients reported the presence of any urinary symptom at 3 or 12 months after stroke (Table 2). The most common symptom was nocturia, with more than 70% reporting it at 3 or 12 months. Next common was any urinary incontinence (>35% at 3 or 12 months), with urge incontinence being more frequent than stress incontinence. When the need to pass urine at least seven times per

Table 1. Comparison of baseline variables between responders at 12 months and all first ever stroke survivors at 12 months who were not included in this substudy (non-responders)

Characteristic	Responders[a], $n = 340$	Non-responders[a], $n = 465$	*P*-value
Demographics			
Males	177 (52.1)	220 (47.3)	0.18
Age, mean (SD)	72.1 (13.6)	72.2 (14.7)	0.92
Stroke type			
Intracerebral haemorrhage	38 (11.2)	58 (12.5)	0.58
Undetermined stroke type	10 (2.9)	29 (6.2)	0.03
Ischaemic	292 (85.9)	378 (81.3)	0.09
TACI	35 (10.3)	37 (8.0)	0.25
PACI	118 (34.7)	160 (34.4)	0.93
POCI	68 (20.0)	90 (19.4)	0.82
LACI	81 (23.3)	120 (25.8)	0.52
Stroke severity[b]			
Mild	202 (59.4)	301 (64.7)	0.12
Moderate	89 (26.2)	107 (23.0)	0.30
Severe	49 (14.4)	57 (12.3)	0.37
Barthel index	16.5 (0.31)	15.9 (0.56)	0.32

TACI, total anterior circulation infarct; PACI, partial anterior circulation infarct; POCI, posterior circulation infarct; LACI, lacunar infarct; Interval deaths refer to deaths occurring between 3 and 12 months.

[a]Number (%) unless otherwise indicated.

[b]Patients with two or more features of dense hemiplegia, dysphasia and unconsciousness at stroke onset were termed 'severe', those with only one feature were termed 'moderate', and those with none were termed 'mild'.

Table 2. Urinary symptoms after first-ever stroke

Symptoms	*n*	Patients with symptom	
	3 months/ 12 months	3 months *n* (%)	12 months *n* (%)
Any urinary symptoms	293[a]/332	245 (83.6)	273 (82.2)
Male	150/171	120 (80.0)	131 (76.6)
Female	143/161	125 (87.4)	142 (88.2)
Any urinary incontinence	292[a]/332	127 (43.5)	125 (37.7)
Male	149/170	44 (29.5)	42 (24.7)
Female	143/162	83 (58.0)	83 (51.2)
Urge incontinence			
Leakage before could reach toilet	292[a]/331[a]	108 (37.0)	108 (32.6)
Leakage perceived as a problem	291[a]/328[a]	69 (23.7)	75 (22.9)
Stress incontinence			
Leakage when physically active	286[a]/331[a]	59 (20.6)	54 (16.3)
Leakage perceived as a problem	286[a]/329[a]	35 (12.2)	32 (9.7)
Urinary frequency			
Passes urine greater than 7 or more times a day	292[a]/331[a]	51 (17.5)	59 (17.8)
Passes urine greater than 9 or more times a day	292[a]/331[a]	22 (7.5)	33 (6.9)
Frequency perceived as a problem	292[a]/332[a]	46 (15.8)	51 (15.4)
Nocturia			
Gets up at night to pass urine	292[a]/328[a]	231 (79.1)	253 (77.1)
Gets up more than once a night to pass urine	292[a]/328[a]	110 (37.7)	150 (45.7)
Nocturia perceived as a problem	291[a]/328[a]	70 (24.1)	63 (19.2)

[a]Missing data in questionnaires for some patients.

Table 3. Natural history of reported urinary incontinence up to 12 months after first-ever stroke ($n = 237$)

Type of urinary incontinence	Pre-stroke, *n*(%)[a]		3 months, *n*	12 months, *n*	
				Yes	No
Any urinary incontinence	Yes	34 (14.3)	Yes	34	29	5
			No	0	0	0
	No	203 (85.7)	Yes	64	41	23
			No	139	16	123
Urge urinary incontinence	Yes	29 (12.3)	Yes	29	22	7
			No	0	0	0
	No	208 (87.7)	Yes	53	33	20
			No	155	18	137
Stress urinary incontinence[a]	Yes	20 (8.6)	Yes	19	12	7
			No	1	1	0
	No	213 (91.4)	Yes	24	10	14
			No	189	13	176

[a]Four patients with missing data for stress urinary incontinence.

day was used as the definition, urinary frequency was experienced by 17.8% of participants at 12 months. When urinary frequency was defined as the need to pass urine on at least nine occasions per day, this prevalence was 6.9%. For each of the urinary symptoms, some patients did not perceive the symptom to be a problem.

The natural history of urinary incontinence is displayed in Table 3. Among patients who responded to the questionnaire at both time periods, 34 (14.3%) patients reported the presence of pre-stroke urinary incontinence. Of those without pre-stroke urinary incontinence, 64 (31.5%) reported the occurrence of new urinary incontinence at 3 months after stroke, of whom 23 (35%) patients reported complete resolution of symptoms at 12 months. Among those who were free of urinary incontinence both before and at 3 months after stroke, 16 (11.5%) later developed symptoms of urinary incontinence at 12 months (Table 3). A similar pattern of incidence and recovery was seen for urge incontinence, whereas a higher proportion (58%) of patients who developed stress incontinence was likely to show recovery in the long term (Table 3).

In univariable regression analyses, greater age ($P < 0.001$), female sex ($P < 0.001$), pre-stroke urinary incontinence ($P < 0.001$) and greater stroke severity were associated with urinary incontinence. Patients with severe strokes were twice as likely (OR = 2.34, 95% CI: 1.23–4.48) to have urinary incontinence 12 months after stroke compared with those with mild strokes. In multivariable regression, increasing age ($P < 0.001$), female sex, ($P = 0.002$), pre-stroke urinary incontinence ($P < 0.001$) and severe strokes ($P = 0.01$) remained independently associated with urinary incontinence (please see the table in Supplementary data available in *Age and Ageing* online, Appendix 2). There was an interaction between stroke severity and age such that the effect of stroke severity was magnified with increasing age (P for interaction = 0.05). There were no other interactions observed between variables.

Discussion

To our knowledge, these are the first reported data from a population-based stroke sample on the spectrum of post-stroke urinary symptoms and the natural history of stress and urge incontinence. The burden of urinary symptoms is high in survivors of first-ever stroke, with nocturia being most common. Although some resolution occurred, most remain affected 1-year after stroke. Age, female sex, stroke severity and pre-stroke urinary incontinence are predictors of persistent urinary incontinence, with age modifying the effect of stroke severity.

We found that more than 80% of survivors of a first-ever stroke in this sample reported the presence of any urinary symptom. Using standard definitions of symptoms based on International Continence Society criteria [12], nocturia and urge urinary incontinence were the most frequently reported abnormalities, with fewer patients describing other symptoms such as stress urinary incontinence and urinary frequency. These results are similar to the findings from previous studies [1, 6].

The examination of the changes in urinary state after stroke provides a perspective on natural history. Unsurprisingly, those with pre-stroke urinary incontinence more often remained incontinent in the long term. Approximately a third of patients developed new symptoms of urinary incontinence at 3 months after the stroke, of whom about a third reported recovery of symptoms at 12 months. The proportions experiencing transitions was similar to that reported in a previous study [2] where

31% had recovered from urinary incontinence at 12 months and 8% had developed new urinary incontinence at 12 months. Although the location of stroke itself may determine the presence of incontinence (e.g. anterior cerebral artery infarcts), it is commonly seen among other subtypes of stroke. This may be due to other factors related to stroke (reduced mobility, cognitive impairment, recurrent events) and factors unrelated to stroke (medications, infections, detrusor overactivity etc). It would be interesting to determine the contributions of such factors to changes in urinary state, but this information was not collected in this study.

Female sex and pre-stroke urinary incontinence were independently associated with urinary incontinence at 12 months, with age modifying the effect of stroke severity on the risk of urinary incontinence. Similar data have been reported in previous stroke population-based studies [2, 8], although the data on sex are inconsistent. A potential explanation for an effect of sex may lie in differences in genitourinary risk factors, with women generally being at higher risk [17]. Although stroke severity was not associated with post-stroke urinary incontinence in either of these population-based studies, it fits with the well understood phenomenon of patients with larger strokes having greater deficits.

Strengths of this study include its population-based design, large sample size, rigorous case ascertainment and definition, and the use of a standardised Urinary Symptoms Questionnaire based on accepted definitions of urinary symptoms. Limitations include bias due to selection or attrition, use of self- or proxy report and the lack of measurement of interval factors explaining change in continence status. Although participation rates were moderate, the proportion of people who were included in this substudy from the entire NEMESIS sample was low. There were no major differences between responders and those not included for age, clinical indicators of stroke severity and sex. However, as the proportion of interval deaths was higher among those not included this group may have suffered more severe strokes. Thus the true prevalence of urinary symptoms after stroke may be underestimated. A greater proportion of those not included had strokes of undetermined type, although the distribution of stroke severity was similar between groups within this category. Self-report bias may lead to underestimation of prevalence as patients may often be reluctant to admit symptoms or may deny symptoms if cognitively impaired. The use of proxy respondents may have also resulted in measurement error but this is unavoidable in large-scale stroke surveys.

In summary, urinary symptoms are common in first-ever stroke survivors. Furthermore, many patients develop urinary incontinence during the first year after stroke. Elucidation of clinical factors contributing to these symptoms may assist in determining the appropriate treatment and care for patients. Better care of people with urinary symptoms after stroke is an important and under-recognised need as such symptoms are highly likely to affect quality of life [1].

Key points

- Urinary symptoms were present in 80% of patients over 1 year, with nocturia being the commonest.
- At 3 and 12 months after stroke, urinary incontinence was present in 43.5 and 37.7% respectively, with urge incontinence being most common.
- Of those with new post-stroke urinary incontinence early after stroke, 35% reported recovery at 12 months.
- Of those who were free of urinary incontinence early after stroke, 11.5% of patients developed new incontinence at 12 months.
- Greater age at stroke onset, female sex, pre-stroke urinary incontinence and severe strokes were factors predicting urinary incontinence at 12 months.

Supplementary data

Supplementary data mentioned in the text is available to subscribers in *Age and Ageing* online.

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Oropharyngeal dysphagia as a risk factor for malnutrition and lower respiratory tract infection in independently living older persons: a population-based prospective study

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Abstract

Objective: to assess the role of oropharyngeal dysphagia (OD) as a risk factor for malnutrition and/or lower respiratory tract infection (LRTI) in the independently-living population of 70 years and over.
Design: a population-based cohort study.
Subjects and setting: persons 70 years and over in the community (non-institutionalised) were randomly selected from primary care databases.
Measurements: the volume-viscosity swallow test (V-VST) was administered by trained physicians at baseline to identify subjects with clinical signs of OD and impaired safety or efficacy of swallow. At the one year follow-up visit, hand grip, functional capacity (Barthel score), nutritional status (mini nutritional assessment, MNA) and LRTI (clinical notes) were assessed.
Results: two hundred and fifty-four subjects were recruited (46.5% female; mean age, 78 years) and 90% of them (227) were re-evaluated one year later. Annual incidence of 'malnutrition or at risk of malnutrition' (MNA <23.5) was 18.6% in those with basal signs of OD and 12.3% in those without basal signs of OD ($P = 0.296$). However, prevalent cases of 'malnutrition or at risk of malnutrition' at follow up were associated with basal OD (OR = 2.72; $P = 0.010$), as well as with basal signs of impaired efficacy of swallow (OR = 2.73; $P = 0.015$). Otherwise, LRTI's annual incidence was higher in subjects with basal signs of impaired safety of swallow in comparison with subjects without such signs (40.0 versus 21.8%; $P = 0.030$; OR = 2.39).