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Readmission rate and related risk factors of ischemic stroke patients after 3 months of discharge in Southwest China

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Abstract

Background: Readmission after stroke is common, but limited data is available in West China. This study aimed to assess the frequencies and influencing factors of unplanned readmissions within 3 months after hospital discharge. *Methods*: This was a retrospective study in a single center. In our study, 596 ischemic stroke patients who were admitted to the Department of Neurology of West China Hospital from November 2011 to August 2012 were enrolled. Demographic data, disease data and follow–up data were collected at first admission and after 3 months of discharge. The readmission rate and risk factors were calculated. *Results*: Of 596 ischemic stroke patients, the readmission rate was 19.30% (115/596) within three-months, the top three reasons for readmission were needs of rehabilitation (74/115, 64.35%), recurrence of stroke (14/115, 12.17%), complications (11/115, 9.57%). The readmission was associated with older age, whether patients have indwelling catheter and endotracheal tube and pressure sores. ($P < 0.05$)
Conclusions: The rate of readmission within 3 months in ischemic stroke patients was 19.30%. Greater attention should be paid to the elderly patients and patients with endotracheal tube on discharge to reduce readmission. Extended nursing care is also needed to reduce the readmission rate of patients with ischemic stroke.

Keywords: Readmission rate, ischemic stroke, risk factors, China

INTRODUCTION

Stroke is the second leading cause of death in the world and the leading cause of death in China.[1] Besides, stroke is the third most common cause of disability worldwide.[1] In China, the disability-adjusted life-years (DALYs) caused by stroke has increased to 38.91 million in 2016.[1] Ischemic stroke is the most common type and accounted for 80% of all the stroke patients. According to the reports of National Epidemiological Survey of Stroke in China (NESS-China), the rate of recurrent stroke at 3, 6, and 12 months after initial ischemic stroke was 10.9%, 13.4% and 14.7%, respectively.[2] Readmission after ischemic stroke is common and only 15% of stroke patients survived admission-free for 5 years. However, more than 90% of readmissions are unplanned, and up to 13% may be potentially preventable.[3,4] Readmission leads to severe disability, increasing mortality and higher costs. Thus, it is urgently important to explore the risk factors of readmission to reduce the readmission rate of ischemic stroke.

Many studies have explored the readmission rate and risk factors in ischemic stroke patients. Some risk factors (e.g., multiple antiepileptic drugs, seizure with major complication or comorbidity and diabetes)[5] have been found to be associated with 30-day readmission[6], 6-months readmission and 1 year or longer readmission.[7] A study also found that stroke patients discharged from non-teaching hospitals were at a significantly higher risk of 30-day readmission than teaching hospitals.[4] As far as we know, almost half of the first readmissions occur within 3-months. Unfortunately, little is known about the rate and the factors of 3-months readmission from the previous studies.[8] The previous studies paid more attention to the early months of post-discharge (e.g., 7days and 1 month) or the late months of post-discharge (e.g., 6 months or longer), and 3-months has been overlooked.

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Therefore, we explored the readmission rate in stroke patients within 3 months, and assessed the potential risk factors for readmission. The aims of this study were to (1) Estimate frequencies of unplanned readmissions in ischemic stroke patients within 3 months after discharge, (2) Explore the risk factors of readmission in ischemic stroke patients.

METHODS

This was a retrospective study in a single center. This study was conducted in West China Hospital of Sichuan University from November 2011 to August 2012. The patients were consecutively enrolled at first admission from the Stroke Unit in West China Hospital of Sichuan University from November 2011 to August 2012. We used the convenience sampling in this study.

Source data and instruments

We collected all the data with questionnaire through face-to-face, medical examination or telephone. The data included the demographic data, disease data and follow-up data. Demographic data was acquired from the patient or family member at first admission. Disease data were collected by a neurologist on the day of admission and discharge. Follow-up data were collected at 3 months after discharge through telephone.

Demographic data: Demographic included age, sex, occupation, educational level, marital status, region and length of stay.

Disease data: At first admission, functional status, lifestyle and dietary habits were collected. Functional status included the National Institutes of Health Stroke Scale (NIHSS) score, modified Rankin Scale (mRS), activities of daily living (ADL) score, homocystein, atherosclerosis, heart disease, diabetes mellitus, hypertension and abnormal blood lipid. Lifestyle and dietary habits included smoking history, current smoker, high fat diet and high salt diet.

At discharge, the length of stay and whether they had nasogastric tube, catheter, tracheal tube, pressure ulcers were documented as disease data. The NIHSS was used to assess the severity of acute ischemic stroke. It has 11 items, the highest score is 45, the lowest score is 0. Patients with NIHSS ≤ 15 were mild neurological deficit, 16-30 were moderate and 31-45 were severe. The mRS scale which contains 6 items was used to evaluate the patients' ability to live independently. The score ranged from 0 to 5. The lower the mRS score, the more independently the patient live. ADL indicated the patients' self-care ability in daily living. It contains 10 items and the score ranged between 0 and 100. The higher the score, the less help from others they need.

Follow-up data: Patients were followed up by telephone at 3 months after discharge. Whether they were re-hospitalized, reasons for readmission, medication adherence, attend the clinic regularly, monitor the blood pressure regularly, monitor the blood sugar regularly, monitor the blood lipid regularly and had rehabilitation training were collected. Patients were asked if they were actually taking their medication and good adherence was defined as more than 95% of prescribed doses in the past 3 months.[9]

All unplanned readmissions within 3 months after discharge were registered and divided into predefined categories. Only the first readmission within each category was registered for each patient.

Inclusion and exclusion criteria

Patients should satisfy the following inclusion criteria at first admission. (1) Over 18 years of age; (2) Diagnosed as ischemic stroke. Ischemic stroke was defined as a neurologic deficit lasting more than 24 hours or a clinically transient ischemic attack where computed tomography or magnetic resonance imaging showed infarctions related to the initial clinical symptoms.[10] (3) Cerebral infarction was determined by a neurologist based on computed tomography (CT) or magnetic resonance imaging (MRI).

The followings were excluded from the study: Patients who died during first hospitalization or were unable to be contacted during post-discharge; Patients who were discharged to palliative care; Patients or family member who refused to participate; Patients with transient ischemic attack (TIA) and hemorrhagic cerebral infarction.

Sample size

According to the experience and method of multivariate analysis, the sample size should be at least 10 times of the number of variables.[11] According to the local and international literature, Chinese cultural background, customs and regional characteristics, 31 factors in the general situation questionnaire were selected as the analysis variables. Taking whether the patients with ischemic stroke were admitted to hospital

within 3 months after discharge as the response variable, the sample size was 310 cases, plus 10-20% of the rate of lost visits, the sample size should be at least 400 cases, combined with human, material and financial factors. Finally, the sample size was determined to be about 596.

Ethics approval

The study was approved by the Ethics Committee of West China Hospital of Sichuan University. Informed consent was obtained from each patient or family member.

Statistical analysis

SPSS 17.0 statistical software was used to analyze the data. Frequencies and relative frequencies (%) were used to describe the categorical variables. For continuous variables, if the data is normally distributed, we report as mean ± SD (Standard Deviation) with range (min – max values). If the data is not normally distributed, we report as median with IQR (Inter Quartile Range). Chi-square test or *t* test were used to compare between two groups. Variables among more than 2 groups were performed by one-way ANOVA. Multivariate logistic regression analysis was performed for significant independent variables in one-way analysis to determine the risk factor. Factors with important clinical significance but no statistical significance are also included. The 95% confidence interval is analyzed for the significance of OR. Statistical significance was defined as $P < 0.05$.

RESULTS

Patient characteristics

A total of 674 patients were enrolled. Seventy-one (10.53%, 71/674) died during first hospitalization and 7 (1.04%, 7/674) were lost to contact during the follow-up. Finally, 596 patients were successfully followed up within 3 months after discharge. A total of 115 (19.30%, 115/596) patients readmitted within 3 months after discharge. The characteristics of patients was shown in Table 1.

Frequencies and risk factors of unplanned readmission

Frequencies and causes of unplanned readmission were presented in Table 2. The univariate analysis showed that patients in two different groups had significant differences in these characteristics (age, length of stay, NIHSS score at admission, mRS score, ADL score, nasogastric tube, catheter, tracheal tube and pressure ulcer at discharge; and whether attended the clinic regularly, monitor the blood pressure and blood sugar, blood lipid regularly, whether rehabilitation exercise). ($P < 0.05$)

In logistic regression, older age (P=0.023), catheter at discharge (P=0.020), tracheal tube at discharge (P=0.025), pressure ulcers at discharge (P=0.027) were the main risk factors of unplanned readmission.

DISCUSSION

Our study found that the unplanned readmission rate after 3 months in patients with Ischemic Stroke was 19.30%. Age, catheter, tracheal tube and pressure were independent risk factors of readmission.

In our study, the unplanned readmission rate after 3 months in patients with ischemic stroke was 19.30%, which was similar with the corresponding data in Taiwan (17%)[12,13] and Norway (18.8%).[14]

Age is one independent risk factor for readmission in our study. The cumulative effect of aging on cardiovascular and brain system could significantly increase the risk of stroke occurrence and recurrence over a long period of time.[7,15-18] Although age is not modifiable, it is helpful for clinicians to identify which patients are prone to recurrence and re-hospitalization.[8] Perhaps elderly patients may stay in hospital longer. Hospital costs may then be higher. The authorities should make policies to provide more financial support for the elderly patients.

Catheter and pressure ulcer were also independent risk factors for readmission in ischemic stroke patients. In addition, we found that discharge IS patients with tracheal intubation were almost six times more likely to be readmitted than those without tracheal intubation, which was similar to the previous research.[19] These three influencing factors (catheter, tracheal tube and pressure) all belonged to specialist care. These results may be explained by the medical resource and nursing care pattern in China. These patients with catheter, tracheal tube and pressure sores all had a higher demand for nursing care after discharge.[20] In China, most stroke patients return home and were taken care by untrained caregivers at home after discharge. However, these untrained caregivers lack professional knowledge and skills. These may contribute to the occurrence of potentially avoidable events such

Table 1: Characteristics of all patients admitted for ischemic stroke (n=596)

Variables	n (%) or (Mean ± SD) (Range)
Age	62 ± 14.33 (19-91)
Age group	
< 45 years old	72 (12.08)
45~54 years old	98 (16.44)
55~64 years old	132 (22.15)
⩾ 65 years old	294 (49.33)
Sex	
Female	222 (37.25)
Male	374 (62.75)
Occupation	
Unemployed or other	217 (36.41)
Farmers	115 (19.29)
Staff	56 (9.40)
Government	60 (10.07)
Retired	148 (24.83)
Education	
Illiteracy	39 (6.54)
Primary school	152 (25.50)
Junior high school	156 (26.18)
Senior high school	132 (22.15)
Junior college	55 (9.23)
Bachelor degree or above	62 (10.40)
Marital status	
Married	558 (93.62)
Unmarried or single	38 (6.38)
Region	
Local resident	261 (43.79)
Provincial resident or other	335 (56.21)
Length of stay	11.24 ± 9.07 (1-83)

as unplanned extubation or aggravate pressure sores.[21,22] Moreover, tracheostomy care, as an important and professional procedure in nursing care, more professional knowledge and skills are required.[23] On the other hand, when patients discharged from hospital, the catheter and pressure ulcer may reflect the severity of the disease and the prognosis is worse, and the patients are more likely to re-hospitalize. Last but not least, most community hospitals in our country have not developed pressure care at present, and patients may choose re-admission.

In the USA, according to the American Insurance System[24], 45% of stroke patients chose extended care after discharge, while only 12% chose family care. However, in China, especially in west China, there is lack of sufficient continuous nursing services for patients after discharge. Most of the specialized nurses serve at large general hospitals and community nurses are relatively deficient in the technical aspects of specialized nursing operations. The lack of continuing nursing care may result in increased complications and readmission. This indicated that we should extend nursing care to reduce the readmission rate, such

Table 2: Characteristics of patients by readmission

Variables	Readmitted N=115	Not readmitted N=481	OR	95%CI	*P* value
Socio-demographics					
Age group					
(Mean±SD)(Range)	66.46±13.09(34-89)	60.93±14.42(19-91)	_	_	**<0.001**[a,*]
Sex (Female, %)	43(37.39)	179(37.21)	0.992	0.652-1.511	0.972[b]
Occupation(%)					
Unemployed or other	35(30.43)	182(37.84)	1.187	0.370-3.816	0.773[c]
Farmers	19(16.52)	96(19.96)	1.636	0.475-5.632	0.435[c]
Officers	12(10.44)	44(9.15)	1.347	0.388-4.672	0.639[c]
Leaders	11(9.57)	49(10.18)	2.073	0.676-6.358	0.203[c]
Retire	38(33.04)	110(22.87)	1.177	0.382-3.631	0.776[c]
Degree of education					
Illiteracy	7(6.09)	32(6.65)	1.078	0.433-2.684	0.872[c]
Primary school	29(25.22)	123(25.57)	0.872	0.347-2.196	0.772[c]
Junior high school	25(21.74)	131(27.23)	1.121	0.445-2.823	0.808[c]
Senior high school	26(22.61)	106(22.04)	1.714	0.624-4.709	0.296[c]
Junior college	15(13.04)	40(8.32)	1.264	0.455-	0.653[c]
Bachelor degree or above	13(11.30)	49(10.19)	0.000	3.5160.000	0.999[c]
Marital status (Married,%)	106(92.17)	452(93.97)	0.756	0.347-1.644	0.480[b]
Living condition					
(Local resident, %)	53(46.09)	208(43.24)	0.911	0.609-1.361	0.649 [b]
Functional Status& Co-morbidity					
NIHSS score at admission (Mean ±SD) (Range)	7.51±6.18(0-26)	5.32±5.10(0-28)	_	_	<0.001 [b,*]
mRS score at admission (Mean±SD) (Range)	2.58±1.28(0-5)	2.12±1.24(0-5)	_	_	<0.001 [a,*]
ADL score at admission (Mean±SD) (Range)	70.04±29.42(0-100)	79.70±26.49(0-100)	_	_	<0.001 [a,*]
Abnormal Homocysteine,%	18(15.65)	68(14.14)	1.127	0.641-1.982	0.678 [b]
Atherosclerosis,%	71(61.74)	247(51.35)	1.092	0.869-1.371	0.133 [b]
Heart disease,%	23(20.00)	70(14.55)	1.468	0.870-2.475	0.148 [b]
Diabetes Mellitus,%	52(45.22)	180(37.42)	1.380	0.915-2.082	0.124 [b]
Hypertension,%	76(66.09)	304(63.20)	1.135	0.739-1.741	0.563 [b]
Abnormal Blood Lipid,%	33(28.70)	146(30.35)	0.923	0.590-1.446	0.728 [b]
Lifestyle & Dietary habits					
Smoking history (yrs.) (Mean±SD) (Range)	22.50±18.74(0-60)	18.50±16.35(0-60)	–	–	0.124 [a]
Current Smoker,%	35(30.43)	168(34.93)	0.813	0.524-1.261	0.354 [b]
High fat diet	3(2.61)	5(1.04)	0.392	0.092-1.665	0.205 [b]
High salt diet	3(2.61)	8(1.66)	1.584	0.414-6.065	0.502 [b]
Discharge characteristics					
Length of stay (Mean ±SD) (Range)	12.80±9.04(1-83)	10.87±9.05(1-60)	_	_	<0.001 [a,*]
Nasogastric tube at discharge,%	19(16.52)	27(5.61)	3.328	1.778-6.229	<0.001 [b,*]
Catheter at discharge,%	25(21.74)	35(7.28)	3.540	2.020-6.023	<0.001 [b,*]
Tracheal tube at discharge,%	6(5.22)	4(0.83)	6.564	1.821–23.660	<0.001 [b,*]
Pressure ulcers at discharge,%	18(15.65)	23(4.78)	3.695	1.920-7.111	<0.001 [b,*]
Medicine adherence,%	109(94.78)	448(93.14)	0.747	0.305-1.828	0.523 [b]
Attend the clinic regularly,%	86(74.78)	273(56.76)	0.218	0.126-0.378	<0.001 [b,*]
Monitor the blood pressure regularly,%	108(93.91)	380(79.00)	4.101	1.851-9.084	0.001 [b,*]
Monitor the blood sugar regularly,%	91(79.13)	256(53.22)	3.333	2.054-5.408	<0.001 [b,*]
Monitor the blood lipid regularly,%	72(62.61)	193(40.12)	2.499	1.643-3.801	<0.001 [b,*]
Rehabilitation exercise,%	44(38.26)	95(19.75)	2.518	1.625-3.902	<0.001 [b,*]

*a t test. b Chi-squared test. c one-way ANOVA *p < 0.05.*

Table 3: Logistic regression model predicting the likelihood of hospital readmission within 3 months (N=596)

Variables	*β*	*S.E.*	*Wald*	*P*	*OR*	*95%CI*
Age	0.022	0.009	2.202	0.023*	1.022	1.003-1.041
Length of stay	0.000	0.013	0.003	0.958	0.999	0.975-1.025
Marital status	0.269	0.251	1.148	0.284	1.309	0.800-2.142
Living condition	-0.116	0.205	0.321	0.571	0.890	0.595-1.331
NIHSS score at admission	0.016	0.035	0.202	0.653	1.016	0.948-1.088
mRS score at admission	0.072	0.184	0.152	0.696	1.074	0.750-1.539
ADL score at admission	0.001	0.008	0.008	0.927	1.001	0.984-1.017
Heart disease	-0.078	0.315	0.062	0.804	0.925	0.499-1.714
Diabetes Mellitus	0.155	0.243	0.405	0.525	1.167	0.725-1.880
Nasogastric tube at discharge	-0.034	0.484	0.005	0.945	0.967	0.374-2.498
Catheter at discharge	0.918	0.395	5.415	0.020*	2.505	1.156-5.428
Tracheal tube at discharge	1.746	0.782	4.992	0.025*	5.733	1.239-26.520
Pressure ulcers at discharge	0.903	0.409	4.866	0.027*	2.466	1.106-5.499
Attend the clinic regularly	0.121	0.072	2.861	0.091	1.129	0.981-1.299
Monitor the blood pressure regularly	0.193	0.125	2.403	0.121	1.213	0.950-1.549
Monitor the blood sugar regularly	0.121	0.136	0.791	0.374	1.129	0.865-1.473
Monitor the blood lipid regularly	0.131	0.119	1.214	0.271	1.139	0.903-1.437
Rehabilitation exercise	0.186	0.112	2.743	0.098	1.205	0.966-1.501
High fat diet	-0.394	0.573	0.471	0.492	0.675	0.219-2.075
High salt diet	-0.105	0.500	0.044	0.834	0.901	0.338-2.399
Constant	-4.933	1.357	13.216	0.000	0.007	

*$P < 0.05$

as setting up nursing center for stroke outpatients to provide catheter care, wound care, telephone consultation service. Hopefully these extended nursing care will help to reduce the readmission rate of patients with ischemic stroke.

There were several limitations in this study. First, the patients were collected from one single hospital, the findings may not be generalized. We propose to collect data from more hospitals. Second, some data were not collected such as social support. Third, some self-report data may be subjective or have recall biases.

In conclusion, readmission of ischemic stroke patients within 3 months after discharge was

frequent in Chengdu, west China. Systematic clinical evaluation of discharged patients was very important. For the elderly patients with gastric tube, tracheal tube and pressure ulcer, nurses should strengthen health guidance and follow-up after discharging, in order to reduce the readmission rate.

DISCLOSURE

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Conflict of interest: None

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