D. まとめ／考察

本研究により、

1) 対象者 562 名のうち、「脳梗塞」457 名（81.3%）、「脳出血」85 名（15.1%）、「くも膜下出血」20 名（3.6%）であった。
2) 男性の割合は、「脳梗塞」43.5%、「脳出血」37.6%、「くも膜下出血」10.0%、平均年齢は、「脳梗塞」85.1±5.5 歳、「脳卒中」83.2±5.6 歳、「くも膜下出血」82.4±4.1 歳であった。
3) 観察終了時点の在宅療養継続者の割合を病型別にみると、「脳梗塞」59.5%、「脳出血」68.2%、「くも膜下出血」45.0%であった。
4) 在宅療養継続率を病型別にみると、退院後 30 日時点では、「脳梗塞」94.1%、「脳出血」96.5%、「くも膜下出血」85.0%、退院後 90 日時点では、「脳梗塞」83.4%、「脳出血」87.0%、「くも膜下出血」70.0%、退院後 180 日時点では、「脳梗塞」66.7%、「脳出血」75.9%、「くも膜下出血」53.3%、退院後 360 日時点では、「脳梗塞」52.3%、「脳出血」52.0%、「くも膜下出血」40.0%であった。
5) くも膜下出血の患者は、脳出血の患者に比べ、在宅療養継続率が有意に低かった。

などがわかった。

（本研究の限界）

本研究では、入院原因疾患に関する情報が 5 月診療分にしかないため（データ上の制約）、再入院が脳卒中によるものなのか、他の疾患によるものなのかは分類できていない。

E. 結論

医療機関を対象とした退院後の再入院調査では、他の医療機関への再入院の実態が把握できない（過小評価される）ため、実際の再入院率より低くなる可能性が高い。

その点、医療レセプト調査は、調査項目の制限はあるものの、地域全体の脳梗塞患者の再入院の実態を明らかにする手法として有効なものと考えた。

今後、市町村国保の医療レセプトデータ分析も併せて実施し、全ての年齢階級での脳梗塞患者の再入院の実態を明らかにしたい。

F. 健康危険情報

なし

G. 研究発表

なし

H. 知的所有権の出願・登録状況

なし

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Ⅳ　研究成果の刊行物・別刷

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Multifactorial Analysis of Factors Affecting Recurrence of Stroke in Japan

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Multifactorial Analysis of Factors Affecting Recurrence of Stroke in Japan

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Abstract

Data on factors affecting stroke recurrence are relatively limited. The authors examined potential factors affecting stroke recurrence, retrospectively. The study participants were 1087 patients who were admitted to stroke centers suffering from first-ever ischemic stroke and returned questionnaires with usable information after discharge. The authors analyzed the association between clinical parameters of the patients and their prognosis. Recurrence rate of during an average of 2 years after discharge was 21.3%, and there were differences among stroke subtypes. It was found that the disability level of the patients after discharge correlated well with the level at discharge ($r_s = 0.66$). Multivariate logistic regression analysis of the data shows that modified Rankin Scale score, National Institute of Health Stroke Scale score, gender, age, and family history had statistically significant impacts on stroke recurrence, and the impact was different depending on subtypes. These findings suggest that aggressive and persistent health education for poststroke patients and management of risk factors are essential to reduce stroke recurrence.

Keywords

ischemic stroke, mRS, stroke recurrence, risk factors, NIHSS

Introduction

Stroke is the third leading cause of death in Japan and has a strong impact on public health because of its high prevalence and associated disabilities. Together with the high mortality and morbidity associated with it, stroke is the leading cause of nursing care in Japan, accounting for

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approximately 30% of overall nursing care. The high recurrence rate of stroke is also an important health issue because it results in cumulative disabilities and cognitive dysfunction. The reported recurrence rate of stroke after initial onset varies widely[1] and whether this variation is the result of differences in race, age, gender, or coexisting morbidities among study participants or is simply a result of the methodological differences is not well known. In contrast with extensive data available on initial occurrence of stroke, data on risk factors affecting the recurrence of stroke are limited.

Stroke is classified into ischemic and hemorrhagic types, and the ischemic type (brain infarction) is further divided into several clinical subtypes. The recurrence rate of ischemic stroke is commonly reported to be lower than that of hemorrhagic stroke, but there are considerable differences in prognoses among subtypes of ischemic stroke.[2-6] Various risk factors, such as hypertension, diabetes mellitus (DM), dyslipidemia, atrial fibrillation (AF), and so forth were assumed to affect stroke recurrence as a function of subtype.[5,6] In previous studies, aging was also reported to be an important factor that increases recurrence of stroke.[7,8]

One important factor in stroke recurrence is functional or disability level of the patients after initial stroke. This can be assessed by the modified Rankin Scale (mRS) and National Institute of Health Stroke Scale (NIHSS), in addition to widely suggested risk factors for stroke recurrence. The Rankin Scale was originally introduced by Rankin in 1957 to measure the degree of disability of patients who had suffered a stroke and modified as the mRS by van Swieten et al.[9] NIHSS was developed to measure the overall degree of neurological impairment of stroke patients.[10] To reduce the high recurrence rate of stroke, detection and control of determinants of recurrence after initial stroke together with therapeutic development are needed.

In the present study, we focused on discharged patients who were admitted to high-volume stroke centers in Japan with first-ever ischemic stroke, including transient ischemic attack (TIA) The patient data we analyzed were clinical subtypes of the stroke; mRS and NIHSS scores of the patients; conventional risk factors, such as hypertension, DM, dyslipidemia, and AF; smoking and alcohol consumption; and age, gender, and family history of stroke.[5-8] The required level of nursing care and the medication prescribed for the patients were also monitored.

Methods

Participants of the present study were patients who had suffered from a first-ever ischemic stroke, including TIA; were admitted to 1 of the 2 representative high-volume stroke centers at Aichi and Hiroshima prefectures in Japan; and discharged between December 2006 and January 2009. Under approval of the ethical committee of these 2 medical centers, survey questionnaires were sent to 2052 patients by mail. We were able to associate the clinical data of 1087 patients (53.0%) with their returned questionnaires, which were filled in by the patients or their family. The average period after discharge was 704.3 ± 211.1 days. Clinical data obtained were the day of stroke onset, subtypes of ischemic stroke, records of admission and discharge, prescribed medication, functional or disability level of patients evaluated by mRS and NIHSS scores, and conventional risk factors (hypertension, DM, dyslipidemia, AF, smoking and alcohol consumption, and family history of stroke). We analyzed the association between recurrence of stroke and the above-mentioned parameters. Data on the provision of health education and the required level of nursing care were also obtained. Information for personal identification of the participants was deleted after assignment of optical numbers.

Statistics

Multivariate logistic regression analysis by the forward selection method based on the likelihood ratio was conducted, using recurrence of stroke as a dependent variable and various prognostic

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Table 1. Recurrence by Subtypes of Ischemic Stroke[a]

	Recurrence (+)		Recurrence (−)		Unknown		Total	
Subtype	n	Percentage	n	Percentage	n	Percentage	n	Percentage
Lacunar	79	22.4	272	77.3	1	0.3	352	100.0
Atherothrombotic	58	17.9	263	81.2	3	0.9	324	100.0
Cardioembolic	63	26.4	175	73.2	1	0.4	239	100.0
TIA	18	19.8	71	78.0	2	2.2	91	100.0
Others	14	17.3	67	82.7	0	0.0	81	100.0
Total	232	21.3	848	78.0	7	0.6	1087	100.0

Abbreviation: TIA, transient ischemic attack.
[a]The number of patients analyzed was 1087.

factors as independent variables. In these analyses, participants were limited to 719 patients whose information on all these parameters could be obtained. Spearman's rank correlation coefficient was calculated, using 1034 patients included in this study, to examine the relationship between mRS grade at discharge and that after discharge. All statistical analyses were carried out with the SPSS Statistics Version 17.0 (SPSS Inc, Tokyo, Japan). All significance levels were set at a P value of less than .05 on 2-sided testing.

Results

Characteristics of Participants

Participants were 1087 poststroke patients (70.4 ± 11.7 years old), consisting of 719 (66.1%) male (68.5 ± 11.2 years old) and 368 (33.9%) female patients (74.2 ± 11.6 years old). The distribution of clinical subtypes of initial stroke was as follows: lacunar, 352 (32.4%); atherothrombotic, 324 (29.8%); cardioembolic, 239 (22.0%); TIA, 91 (8.4%); and others 81 (7.5%). The proportion of male participants was highest in atherothrombotic stroke (69.8%), followed by TIA (68.1%) and lacunar stroke (65.1%). The average age of the patients was highest in patients with cardioembolic stroke (73.7 ± 11.4), followed by atherothrombotic stroke (71.3 ± 10.7) and lacunar stroke (69.9 ± 10.3).

Hypertension was observed in about 70% of all patients. DM was found in 39.8% of atherothrombotic patients and 25.5% of cardioembolic patients. Dyslipidemia was observed in almost half of the patients with atherothrombotic stroke, about 40% of those with lacunar stroke or TIA, and 30% of those with cardioembolic stroke. AF was found in 58.6% of patients with cardioembolic stroke. A family history of stroke was observed in about 30% of all patients. Habitual alcohol drinking was found in 30% to 40% of the patients from each stroke-subtype group. Smoking was observed in about 30% of all patients and was lowest in cardioembolic stroke patients (13.9%).

Health education was provided to 74.3% of the patients before discharge. Also, 75.4% of the cardioembolic stroke patients were prescribed an anticoagulant (warfarin), and 72.7% of all the stroke patients were taking antiplatelet agents.

Recurrence of Stroke by Subtypes

As shown in Table 1, the recurrence rate of overall ischemic stroke during an average of 2 years of follow-up after discharge was 21.3%. Recurrence rate by clinical subtypes was highest in

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Table 2. Correlation between mRS Grade at Discharge and after Discharge[a]

		mRS grade after discharge							
		0	1	2	3	4	5	6	Total
mRS grade at discharge	0	169 (65.3%)	54 (20.8%)	18 (6.9%)	7 (2.7%)	5 (1.9%)	4 (1.5%)	2 (0.8%)	259 (100.0%)
	1	86 (32.0%)	107 (39.8%)	49 (18.2%)	16 (5.9%)	0 (0.0%)	8 (3.0%)	3 (1.1%)	269 (100.0%)
	2	44 (21.8%)	58 (28.7%)	67 (33.2%)	24 (11.9%)	5 (2.5%)	2 (1.0%)	2 (1.0%)	202 (100.0%)
	3	11 (9.2%)	14 (11.8%)	43 (36.1%)	31 (26.1%)	12 (10.1%)	5 (4.2%)	3 (2.5%)	119 (100.0%)
	4	4 (3.1%)	3 (2.3%)	12 (9.3%)	29 (22.5%)	34 (26.4%)	29 (22.5%)	18 (14.0%)	129 (100.0%)
	5	0 (0.0%)	0 (0.0%)	1 (1.8%)	4 (7.1%)	4 (7.1%)	26 (46.4%)	21 (37.5%)	56 (100.0%)
Total		314 (30.4%)	236 (22.8%)	190 (18.4%)	111 (10.7%)	60 (5.8%)	74 (7.2%)	49 (4.7%)	1034 (100.0%)

Abbreviation: mRS, modified Rankin Scale.
[a]The number of patients with valid information was 1034. Spearman's rank correlation coefficient (r_s) was calculated as 0.66 ($P < .01$).

cardioembolic stroke patients (26.4%), followed by lacunar stroke patients (22.4%), TIA patients (19.8%), and atherothrombotic stroke patients (17.9%).

Functional Prognosis

As indicated in Table 2, the distribution of mRS scores for the patients at discharge was as follows: grade 0 (no symptoms, 25.0%), 1 (no significant disability, 26.0%), 2 (slight disability, 19.5%), 3 (moderate disability, 11.5%), 4 (moderately severe disability, 12.5%), and 5(severe disability, 5.4%). The mRS score distribution after discharge was as follows: grade 0 (30.4%), 1 (22.8%), 2 (18.4%), 3 (10.7%), 4 (5.8%), 5 (7.2%), and 6 (dead, 4.7%), respectively.

There was a significant correlation, by Spearman's rank correlation coefficient ($r_s = 0.66$), between the mRS grade at discharge and after discharge. The mortality rate of patients with mRS grade 4 at discharge was 14.0% and that with grade 5 was 37.5%. Patients with an mRS grade of more than 4 had a worse prognosis than those with mRS grades of 3 or less.

The proportion of those who needed nursing care after discharge was 34.4%; 9.0% of them were at the required nursing care level 4, and 12.9% were at level 5 (severest disability).

Factors Affecting Recurrence of Stroke

We analyzed the association, by stroke subtype, between stroke recurrence and mRS, NIHSS, hypertension, DM, dyslipidemia, AF, smoking, alcohol consumption, and the patient's gender, age, and family history of stroke using multivariate logistic regression analysis. As indicated in Table 3, we found that mRS grade at discharge, gender, age, and family history were common risk factors for stroke recurrence. By clinical subtype of ischemic stroke, we found that mRS grade at discharge was an independent risk factor for recurrence; mRS grade at discharge and gender were risk factors for atherothrombotic stroke; NIHSS score at discharge, hypertension, DM, and family history were risk factors for cardioembolic stroke; and age was a risk factor for TIA.

Discussion

Reported recurrence of stroke after an initial onset varies widely among studies, from 3% to 22% within 1 year to 10% to 53% within 5 years.[1] The 5-year cumulative risk of stroke recurrence in Australia and the United Kingdom are reported to be 16.6% and 16.2%, respectively,[11,12] and the Akita study in Japan reported a 10-year cumulative recurrence rate of 21% for ischemic stroke.[8] However, higher recurrence rates were observed in other studies.[4,12] The cumulative

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Table 3. Factors Affecting Recurrence of Stroke by Subtypes[a]

Prognostic Factors	Odds Ratio (OR; 95%CI)	*P* Value
Overall ischemic stroke		
mRS grade at discharge	1.249 (1.105-1.412)	.000[b]
Gender	1.706 (1.147-2.538)	.008[b]
Age	1.021 (1.004-1.040)	.019[b]
Family history	1.628 (1.124-2.358)	.010[b]
Lacunar stroke		
mRS grade at discharge	1.469 (1.0009-1.091)	.001[b]
Atherothrombotic stroke		
mRS grade at discharge	1.483 (1.162-1.857)	.004[b]
Gender	2.777 (1.121-6.879)	.027[b]
Cardioembolic stroke		
NIHSS score at discharge	1.049 (1.009-1.091)	.016[b]
Family history	2.202 (1.010-4.803)	.047[b]
Hypertension	3.859 (1.509-9.867)	.005[b]
DM	2.589 (1.189-5.639)	.017[b]
TIA		
Age	1.106 (1.035-1.182)	.003[b]

Abbreviations: OR, odds ratio; CI, confidence interval; mRS, modified Rankin Scale; NIHSS, National Institute of Health Stroke Scale; DM, diabetes mellitus; TIA, transient ischemic attack.

[a]The number of patients analyzed was 719, consisting of 221 atherothrombotic, 166 cardioembolic, 263 lacunar, and 69 TIA patients. Multivariate logistic regression analysis by forward selection method with likelihood ratio was conducted, using recurrence of stroke as a dependent variable and prognostic factors as independent variables.

[b]$P < .01$.

recurrence rates of ischemic stroke at 1, 5, and 10 years from the Hisayama Study,[7] which is one of the representative cohort studies in Japan, were 10.0%, 34.1%, and 49.7%, respectively. By clinical subtypes of ischemic stroke, recurrence rates were 7.2%, 30.4%, and 46.8% after lacunar infarction; 14.8%, 42.0%, and 46.9% after atherothrombotic infarction; and 19.6%, 43.2%, and 75.2% after cardioembolic infarction, respectively.

In our study, a 21.3% recurrence rate of ischemic stroke within an average of about 2 years after discharge was observed overall, with subtype-specific recurrence rates of 22.4% after lacunar infarction, 17.9% after atherothrombotic infarction, 26.4% after cardioembolic infarction, and 19.8% after TIA (see Table 1). These data from our study were consistent with those of the Hisayama study.

There might be several reasons behind the observed differences in the recurrence rates of stroke, such as subtypes of stroke, gender, age, and methodology. An increased recurrent risk of ischemic stroke with age has been observed in previous studies,[5,7,8] with the finding that age is a predictor of stroke recurrence. Among subtypes of ischemic stroke, recurrence rates of lacunar and atherothrombotic infarction were significantly associated with age. In the Hisayama study, cumulative recurrence rates of ischemic stroke, especially of lacunar infarction, increased steadily over the course of 10 years. It was assumed that aging would accelerate atherosclerotic changes in the penetrating arteries, thus increasing the risk of recurrence of lacunar and atherothrombotic infarction.[7]

Another explanation of the difference comes from various risk factors affecting stroke recurrence. Hypertension, DM, dyslipidemia, AF, smoking, and age were considered as risk factors of ischemic stroke. These factors might promote recurrence independently or interactively. The

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Leigh Valley Recurrent Stroke Study emphasized the importance of control of hypertension and AF to reduce the recurrence of ischemic stroke.[13] A Chinese cohort study revealed that hypertension, AF, and smoking were associated with risk of ischemic stroke recurrence.[4] In Japan, the Akita Study[8] showed that younger age at first onset, hypertension, DM, and AF were factors affecting recurrence of stroke. Recurrence of ischemic stroke was associated with male patients, hyperlipidemia, AF, and smoking in a Taiwanese study.[14] The Perth Community Stroke Study found that older age and DM were major predictors of stroke recurrence within 5 years.[11]

In addition to the factors discussed above, the disability level at the time of discharge has been found to be an important risk factor in stroke recurrence. In a hospital-based long-term follow-up study over 20 years, Yokota et al[6] found that disability level at the time of discharge, in addition to AF, ischemic heart disease, and history of TIA, was an important determinant for stroke recurrence. In our present study, we analyzed the association between stroke recurrence and mRS, NIHSS, hypertension, DM, dyslipidemia, AF, smoking, alcohol consumption, gender, age, and family history of strokes, using multivariate regression analysis. Our data show that mRS as well as gender, age, and family history of strokes had a statistically significant impact on ischemic stroke recurrence (see Table 3).

Stroke subtype is also a predictive factor in stroke recurrence and patient health and survival. The population-based Minnesota study revealed, by functional assessment using mRS, that patients with lacunar stroke had better poststroke function status than other subtypes, whereas patients with cardioembolic stroke had the poorest survival.[2] In our study, we also examined the effects of individual risk factors on recurrence by clinical subtype of ischemic stroke and found that the recurrence rates were different by stroke subtype, and the magnitude of impact of risk factors varied among stroke subtypes (see Table 3).

It is important to note that the disability level of the patients in our study, evaluated by mRS, at the time of discharge correlated with the disability level after discharge. Prognosis for patients with mRS grade 4 or 5 was much worse than that for patients with mRS grade 3 or less, and there was a steep increase in mortality among the high-grade mRS patients (see Table 2). These results indicate that mRS could be used not only as a scale for disability but also as a predictive indicator for the prognosis of poststroke patients, including stroke recurrence. It was also suggested that persistent long-term care for poststroke patients, especially for patients with low functional level or severe disability, is very important.

Besides the high mortality and morbidity, stroke is the first leading cause of nursing care in Japan and accounted for 30% of all care.[6] Although this is not directly related to stroke recurrence, we also obtained information on the required level of nursing care for stroke patients. The proportion of the patients who need nursing care after discharge was 34.4%, and more than 20% of the patients (close to two thirds of the patients who needed nursing care) were at the severe nursing care levels of 4 or 5. In the population-based Northern Manhattan Study, quality of life of the patients declined annually up to 5 years after stroke, independently of risk factors.[15]

Previous reports have also indicated that most recurrent episodes of stroke occurred within the first year after the occurrence of initial stroke.[2,12,16,17] The Oxfordshire Community Stroke Project suggested that the risk of recurrence during the first year after the initial stroke was 15 times higher than that in the general population.[18] A large hospital-based stroke registry study in Japan (JSSRS) showed that hypertension and AF contributed to early ischemic stroke recurrence, and DM was independently related to early recurrence of atherothrombotic stroke.[3] Readmission of stroke patients could be as high as 30% within 1 year after discharge; however, this could be for reasons other than stroke recurrence, such as infection and cardiovascular events.[14] Early recurrence of stroke suggested the importance of aggressive health education for poststroke patients and management of treatable risk factors.

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In our study, most of the patients received health education before discharge, 75.3% of cardioembolic stroke patients were prescribed an anticoagulant, and 72.7% of all patients had a platelet aggregation inhibitor. However, as Hirayama et al[19] suggested, insufficient treatment with warfarin and self-cessation of preventive medication were causative factors in stroke recurrence. To help prevent stroke recurrence, the American Heart Association recommends control of blood pressure, DM, hyperlipidemia, cessation of heavy alcohol consumption and smoking, and appropriate exercise and weight control.[20] Aekplakoru et al[21] stressed the importance of implementation of the program to control risk factors along with periodic monitoring. Coull et al[22] also strengthened the necessity of public education and organized health care services to prevent stroke more effectively. Finally, stroke and stroke recurrence can be prevented to a certain extent by the patients themselves, and we would like to emphasize that adequate treatment and management of risk factors by persistent health education for poststroke patients is urgently required to prevent recurrence and subsequent disabilities and to maintain quality of life in these patients.[15,23]

There were some limitations to this study. Participants for analyses were limited to patients admitted to the 2 stroke centers, and usable information was obtained from about half of the stroke patients who were sent questionnaires. The accuracy of the information from the participants was insufficient because of the fact that this study was retrospective. The higher recurrence rates observed in our study may arise from these various reasons and biases.

Conclusion

As the proportion of the elderly population increases, the rates of initial stroke occurrence and the stroke recurrence rate are expected to increase. Recurrence of ischemic stroke was perpetual in Japanese poststroke patients. Various factors were assumed to affect the recurrence of stroke, and these factors may act independently or mutually. The disability level of poststroke patients evaluated by mRS appears to be an important predictor of prognosis. Therefore, careful observation and adequate disease control or risk factor management from early stroke onset throughout the course of treatment are required to prevent the recurrence of stroke, especially for patients with a low functional level or with a high risk aspect of recurrence. We also emphasize that improvements in health education to stroke patients should be made at regional medical facilities.

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Difference in prognoses among subtypes after first-ever ischemic stroke

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ABSTRACT

Stroke has been a leading cause of death in Japan and given a heavy burden on public health due to its high prevalence and associated disabilities. The high recurrence rate of stroke is also a struggling heath issue, resulting in cumulative disabilities and cognitive dysfunction.

In order to verify factors affecting prognosis after initial stroke, including stroke recurrence, we investigated post-stroke patients who were admitted to the stroke centers with

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first-ever ischemic stroke, and analyzed the relationship between characteristics of the patients and their prognoses, retrospectively.

In this study we examined the influences of various factors on the prognosis of post-stroke patients, and found that clinical subtypes of ischemic stroke gave much impact on the prognosis, in addition to conventional risk factors. It may probably caused by different etiology of stroke among subtypes.

These findings suggest that appropriate treatment and persistent health education for post-stroke patients, according to their subtypes, are essential to prevent recurrence and cumulative disabilities.

Key words: ischemic stroke, prognosis, subtype, mRS, nursing care

INTRODUCTION

Stroke has been a leading cause of death in Japan[1] and given a heavy burden on public health due to its high prevalence and associated disabilities. The high recurrence rate of stroke is also a struggling heath issue, resulting in cumulative disabilities and cognitive dysfunction. Stroke, then, accounts for about one fourth of the causes of the long-term nursing care in Japan[2].

Stroke is classified into ischemic type (cerebral infarction) and hemorrhagic type (cerebral hemorrhage). Ischemic stroke is further divided into several clinical subtypes, including lacunar, atherothombotic, cardioemboric strokes, and transient ischemic attack (TIA). Considerable differences in prognosis of patients with first-ever ischemic stroke were reported by several studies[3-8]. Various risk factors, such as age, gender, hypertension, diabetes mellitus (DM), dyslipidemia, atrial fibrillation (AF), were assumed to affect the difference in prognosis of post-stroke patients. We have previously reported that the disability level of patients at discharge well correlated with the level at about two years after discharge[9]. Thus it could be a predictor of prognosis after stroke. Furthermore, a number of articles have been published which give additional knowledge on difference in outcomes by ischemic stroke subtypes[10-13]. In these articles, subtypes of ischemic stroke are assumed to be an important determinant of long-term prognosis.

The purpose of the present study is to examine the influences of subtypes of first-ever ischemic stroke on the prognosis of post-stroke patients. We focused on discharged patients who were admitted to the high-volume stroke centers at Aichi and Hiroshima prefectures in Japan with first-ever ischemic stroke, including TIA.

METHODS

Participants of this study were 2, 052 patients who had suffered from first-ever ischemic stroke, including TIA, and were admitted to the two high-volume stroke centers at Aichi and Hiroshima prefectures in Japan, and discharged between December 2006 and January 2009. Under approval of the ethical committees of these two hospitals, survey questionnaires were sent to the above 2, 052 patients by mail. We were able to associate the clinical data of 1, 087 patients (53. 0%) with their useable returned questionnaires.

Clinical data obtained were the day of stroke onset, subtypes of ischemic stroke, records of admission and discharge, disability level evaluated by modified Rankin Scale (mRS), severity level assessed by National Institute of Health Stroke Score (NIHSS), and conventional risk factors, such as hypertension, diabetes mellitus (DM), dyslipidemia, atrial fibrillation (AF), family history and so forth. Survey questionnaires include recurrence of stroke, present status of health care, prescribed medications and the required level of long-term nursing care. Information on personal identification of the participants was deleted after assignment of optical numbers.

We used mRS and NIHSS for assessing function or severity level of the patients. The mRS is a widely applied measure for evaluating the degree of disability of stroke patients[14]. NIHSS was developed to measure the overall degree of neurological impairment of stroke patients[15].

In order to examine factors affecting the prognosis of post-stroke patients, we analyzed the relationship between ischemic stroke subtypes of the participants and their prognoses. Prognostic factors analyzed were: disability levels evaluated by mRS, status of health care, regular outpatient visit, and required levels of the long-term nursing care.

STATISTICS

Chi-square test was performed to investigate the association between stroke subtypes and their prognoses, such as disability level, status of health care, regular ambulatory care, and required levels of the long-term nursing care.

All statistical analyses were carried out with IBM SPSS Statistics Ver. 19. 0. All significant levels were set at p value of less than 0. 05 on two-sided testing.

RESULTS

1. Characteristics of participants

Participants were 1, 087 post-stroke patients (70. 4 ± 11. 7 years), consisted of 719

(66.1%) male patients (68.5±11.2 years) and 368 (33.9%) female patients (74.2±11.6 years). Distribution of the age peaked at 65-69 years for male, and 80-84 for female. Their averag period after discharge was 704.3±211.1 days.

Clinical subtypes of initial stroke on the participants were lacunar 352 (32.4%), atherothrombotic 324 (29.8%), cardioemobolic 239 (22.0%), TIA 91 (8.4%) and others 81 (7.5%), respectively. Proportion of the male subjects on each subtypes was highest in atherothrombotic (69.8%), followed by TIA (68.1%) and lacunar (65.1%). The average age of the patients was highest in cardioembolic (73.7±11.4 years), succeeded by atherothrombotic (71.3±10.7 years) and lacunar infarction (69.9±10.3 years).

The functional levels of the patients at discharge evaluated by mRS and NIHSS were described in Table 1 and Table 2. As shown in Table 1, the distribution of mRS grades of the participants was "grade 0 (no symptom)" 26.0%, "grade 1 (no significant disability)" 26.1%, "grade 2 (slight disability)" 19.0%, "grade 3 (moderate disability)" 11.4%, "grade 4 (moderately severe disability)" 12.2%, and "grade 5 (severe disability)" 5.2%. The proportion of the participants with mRS grade over 3 by subtypes was highest in cardioembolic 41.0%, followed by atherothrombotic 36.7%, lacunar 20.2%, and lowest in TIA 5.5%. Statistically significant difference in the distribution of mRS grade was observed across ischemic stroke subtypes ($p<0.001$).

The distribution of the severity levels of the participants measured by NIHSS was indi-

Table 1 Distribution of mRS grades at discharge by ischemic stroke subtypes

Subtype	N	mRS grade at discharge (%)						Average (Mean±SD)
		0	1	2	3	4	5	
Lacunar	352 (100.0%)	66 (18.8%)	132 (37.5%)	83 (23.6%)	37 (10.5%)	28 (8.0%)	6 (1.7%)	1.57±1.23
Atherothrombotic	324 (100.0%)	74 (22.8%)	68 (21.0%)	63 (19.4%)	48 (14.8%)	53 (16.4%)	18 (5.6%)	1.98±1.56
Cardioembolic	239 (100.0%)	52 (21.8%)	52 (21.8%)	37 (15.5%)	27 (11.3%)	40 (16.7%)	31 (13.0%)	2.18±1.74
TIA	91 (100.0%)	69 (75.8%)	10 (11.0%)	7 (7.7%)	4 (4.4%)	1 (1.1%)	0 (0.0%)	0.44±0.90
Others	81 (100.0%)	22 (27.2%)	22 (27.2%)	17 (21.0%)	8 (9.9%)	11 (13.6%)	1 (1.2%)	1.57±1.34
Total	1,087 (100.0%)	283 (26.0%)	284 (26.1%)	207 (19.0%)	124 (11.4%)	133 (12.2%)	56 (5.2%)	1.73±1.52

The distribution of mRS grade was significantly different across subtypes by chi-square test ($p<0.001$).

Table 2 Distribution of NIHSS scores of the patients by ischemic stroke subtypes

Subtype	N	NIHSS score at discharge (%)					Average (Mean±SD)
		0-4	5-10	11-16	17-22	23-	
Lacunar	352 (100.0%)	322 (91.5%)	25 (7.1%)	2 (0.6%)	1 (0.3%)	2 (0.6%)	1.83±2.71
Atherothrombotic	324 (100.0%)	241 (74.4%)	47 (14.5%)	20 (6.2%)	11 (3.4%)	5 (1.5%)	3.64±5.41
Cardioembolic	239 (100.0%)	157 (65.7%)	26 (10.9%)	26 (10.9%)	12 (5.0%)	18 (7.5%)	6.01±8.64
TIA	91 (100.0%)	87 (95.6%)	4 (4.4%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0.62±1.49
Others	81 (100.0%)	72 (88.9%)	9 (11.1%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1.72±1.96
Total	1,087 (100.0%)	879 (80.9%)	111 (10.2%)	48 (4.4%)	24 (2.2%)	25 (2.3%)	3.18±5.58

The distribution of NIHSS score was significantly different among subtypes by chi-square test ($p<0.001$).