Long-term disability after stroke in Iran: Evidence from the Mashhad Stroke Incidence Study

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Abstract

Background: Accurate information about disability rate after stroke remains largely unclear in many countries. Population-based studies are necessary to estimate the rate and determinants of disability after stroke.

Methods: Patients were recruited from the Mashhad Stroke Incidence Study and followed for five years after their index event. Disability was measured using the modified Rankin scale and functional dependency was measured using the Barthel index.

Results: Among 684 patients registered in this study, 624 were first-ever strokes. In total, 69.0% (n = 409) of patients either died or remained disabled at five-year follow-up. Among the first-ever stroke survivors, 18.5% (n = 69) at one year and 15.9% (n = 31) at five years required major assistance in their daily activities. Patients with a history of stroke (before the study period) compared with first-ever strokes were more likely to be disabled at one year (modified Rankin scale > 2 in 40.0% vs. 19.1%; P < 0.001). Advanced age, severity of stroke at the time of admission, diabetes mellitus, and educational level (<12 years) were independently associated with greater disability and functional dependency.

Conclusion: We found that significant disability and functional dependency after stroke in Northeast Iran were largely attributable to the effects of stroke severity and prior dependency.

Keywords
Disability, stroke, population-based studies, Middle East

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Introduction

Although there have been several epidemiological stroke studies conducted in western countries, there are few population-based data from the Middle East. Moreover, the heterogeneity of the scales to measure...
disability and the use of selected populations of people with stroke, such as hospitalized patients alone, further limit our understanding of stroke outcomes. We sought to identify the prevalence, patterns, and factors associated with disability in the long-term after stroke in a population-based cohort from the Mashhad Stroke Incidence Study.

Methods

The study designs, baseline assessments, and data collection have been previously described\(^2\) (Supplement 1). In summary, we recruited all potential cases of stroke in three well-defined neighborhoods (population = 450,229) of Mashhad (population = 2,868,350) Northeast Iran. Patients were invited to participate in face-to-face clinical evaluations after three months, one year, and five years from the date of the index stroke.\(^3\) Follow-up assessments were completed in January 2014, by visiting all patients who were not seen in clinics at their homes and by reviewing major national datasets for death records.\(^4\) We defined disability as a modified Rankin scale (mRS) score > 2, and functional dependency as a Barthel Index (BI) < 60. We used univariable and multivariable logistic regression models (backward stepwise method) to identify factors independently associated with poor clinical outcomes (mRS > 2 or BI < 60). The effects of stroke recurrence on stroke disability and functional dependency were analyzed separately using logistic and linear regression analysis. All statistical analyses were performed using the SPSS version 16.0 software package. \(P < 0.05\) (two-tailed) were considered statistically significant.

Results

Overall 684 patients with stroke, including 624 patients with first-ever strokes (FES), were recruited. The baseline characteristics of the population are shown in Supplement 2. The five-year case fatality and recurrence rates were 57.3% (n = 330) and 12.9% (n = 81). A poor clinical outcome (mRS > 2) was observed in less than one-third of FES survivors (27.8%) with no recurrence at each time point at three months, 69 patients (18.5%) at one year, and 31 patients (15.9%) at five years. At three-month follow-up, 21.3% (n = 87) of survivors required assistance with activities of daily living (BI < 60). Dependency among stroke survivors was almost halved after one year (11.2%) and decreased to 10.5% at five years of follow-up.

After adjusting for age and sex, vascular risk factors, educational level, and Oxfordshire Classification, predictors of poor outcome (mRS > 2) among FES were the National Institutes of Health Stroke Scale (NIHSS) at the time of admission, advanced age (Figure 1), and education <12 years (at three months) (Supplement 3). Similarly, poor functional ability (BI < 60) was associated with NIHSS at admission, advanced age, and a history of diabetes mellitus (at five years) (Supplement 4). There were no differences in the frequency of disability and dependency in women and men or in those with ischemic stroke (IS) and intracerebral hemorrhage (ICH) (Supplements 5 and 6). A good outcome (mRS ≤ 2, BI ≥ 60) was significantly greater in patients with FES than in those with a history of previous stroke (before the index stroke) at all checkpoints. In multivariable analysis, patients with stroke recurrence during the follow-up period had a significantly higher rate of dependency at one-year follow-up (beta: 4.93, 95% CI: 1.65–14.70, \(p = 0.004\)) (Supplement 7). In the linear regression analysis, the severity of disability as well as functional dependency (measured as a continuous variable) increased significantly after stroke recurrence at all follow-up points (Supplement 7).

Discussion

In this study, more than half of patients with FES either died or remained disabled. The proportion of people with disability was greater in those with a history of stroke before the study period rather than FES, but was similar in those with IS and ICH and in women and men. Advanced age, stroke severity, poor educational attainment, stroke recurrence during the follow-up period, and diabetes mellitus were independently associated with disability and functional dependency.

In the current study, 69% of our patients died or remain disabled (mRS > 2) at five years after stroke. This proportion is similar to that observed (70%) in a five-year follow-up study conducted in the UK (Supplement 8). However, the epidemiological context in Iran is substantially different from western countries as stroke occurrence peaks almost one decade earlier than that typically seen in western countries.\(^1\) This early age of stroke occurrence, a larger case fatality, and significant disability indicate a huge burden of stroke in Mashhad and potentially in similar Middle Eastern regions. Similar to others,\(^5\) we found that advanced age was independently associated with disability and functional dependency. This finding was more evident in those aged 70 to 80 years.

Only a few studies have compared disability after IS and ICH. A cross-sectional clinical study of 126 strokes in Turkey was unable to detect a significant difference between mRS scores in those with hemorrhagic stroke and IS, although there was poorer functional status (measured with modified BI) among those with hemorrhagic stroke than IS.\(^6\) We found no difference in
disability between those with IS and ICH; however, the number of people with ICH was small. Our finding of similar post-stroke disability in women and men differs from the findings from previous studies. This finding might be related to the fact that men and women in our cohort experienced strokes at similar ages. This is in contrast to most prior work, where women tend to be older than men at the time of stroke.

From a clinical and public health perspective, it is important to focus on the factors associated with disability after stroke that are modifiable. Similar to previous studies, subjects with a history of previous stroke and vascular risk factors had greater disability than their counterparts, emphasizing the importance of the management of risk factors. The finding that stroke recurrence increased the chance of disability and functional dependency also emphasize the importance of the secondary prevention of stroke. In addition, our finding that the severity of stroke, measured by NIHSS, was independently associated with long-term disability highlights the importance of interventions such as thrombectomy or thrombolytic therapy to reduce the severity of stroke in the hyperacute phase. Unfortunately, at the time that our study was conducted, these treatments were unavailable in Iran.

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**Figure 1.** Prevalence of disability and functional dependency according to (a) modified Rankin Scale and (b) Barthel index in different age sub-group in the total population. The denominator of each column was defined as the number of patients on the selected age category at each follow-up point. While data regarding $mRS = 0$ and $BI = 100$ were calculated, they were not shown to provide a better visual comparison among those with and without disability or functional dependency.
association between poor educational attainment and long-term post-stroke disability rate is also important, requiring long-term public health programs in terms of general awareness.

Our study has some limitations. Despite all attempts, including visiting all missing patients’ addresses in 2014, we were unable to follow-up 6 patients at three months, 8 patients at one year, and 69 patients at five years, mostly due to the change of contact information. In addition, we do not have details of the types and periods of rehabilitation therapy after the stroke and so are unable to determine to what extent such interventions might have affected the final outcomes. Of note, Mashhad had no rehabilitation hospital or a comprehensive rehabilitation plan at the time of the study. Therefore, it is unlikely that a substantial number of patients had long-term physiotherapy/occupational therapy. Despite these limitations, Mashhad Stroke Incidence Study is the first population-based study of stroke in the Middle East and so provides unique data about the long-term effects of stroke among survivors in this region.

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