Chapter 6

Stroke

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1 Introduction

In Japan, the mortality from cerebrovascular disease reached a peak in the late 1960s, and then began to drop consistently. The current cerebrovascular disease mortality is two thirds of the peak rate (Fig. 6.1). However, cerebrovascular disease is the most common underlying disease in functionally dependent older adults and cannot be overlooked in public health. Moreover, given the recent call of amending the issue of health inequality in Japan and worldwide, success in terms of the reduction in the national average is not sufficient. This chapter examines future cerebrovascular disease measures by reviewing socioeconomic status (SES)-related inequalities in cerebrovascular disease based on previous academic knowledge.

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K. Kondo (ed.), *Social Determinants of Health in Non-communicable Diseases*,
Springer Series on Epidemiology and Public Health,
https://doi.org/10.1007/978-981-15-1831-7_6

Fig. 6.1 Change of the mortality from cerebrovascular diseases and other leading causes (per 100,000 population). Cited from Trends of health of nation in 2009, pp. 54

2 SES-Related Inequalities in Cerebrovascular Disease and Risk Factors in Foreign Countries

SES is strongly associated with health condition, and cerebrovascular disease is no exception. Income, educational background, and occupational stratum are often used as measurements of SES. In several longitudinal studies performed mainly in Europe and the USA, it has been shown that SES can predict death by cerebrovascular disease by using any of these items [1]. For example, in a study performed in the USA, SES was separated into four categories by income, educational background, and occupational stratum to analyze mortality statistics by cause of death. The results showed that men with the lowest SES were 2.3 times more likely to die than men with the highest SES (data adjusted for age, survey year, sex, and race) [2]. According to a follow-up study in 50 million people per year in eight countries in Western Europe, similar to other primary disease, the cerebrovascular disease mortality was significantly higher (about 20–60%) in subjects with less education. Such impact was stronger with age [3]. There is also influential evidence in the Asian region. In a diachronic study performed in 580 thousand male public servants in Korea for mortality from both ischemic and hemorrhagic stroke, the worst group of the ranking that classified income into four groups was two times higher than the best group. In addition, SES-related inequalities were also observed in the fatality rate after onset [4].

Many studies have suggested that SES-related inequalities are found in the distribution of risk factors. A health and nutrition examination survey in the USA reported that cardiovascular disease risks such as smoking, lack of exercise, hypertension, and diabetes were most strongly accumulated in the lower-income class,

regardless of race and sex [5]. However, for some risk factors the SES-related inequality has not been clear; for example, for the SES distribution of the serum cholesterol level, the results were heterogeneous [2].

3 SES-Based Inequality in Cerebrovascular Disease in Japan

Fukuda et al. [6] evaluated the SES at the local community level by five phases using the college-going rate and income per person at the local community level in Japan and ecologically estimated the ratio of the mortality from cerebral hemorrhage and from cerebral infarction. As a result, the mortality from cerebral hemorrhage in the local community with the lowest SES was 1.29 times (between 1973 and 1977) and 1.21 times (between 1993 and 1998) higher than the local community with the highest SES. Similarly, the mortality from cerebral infarction was 1.16 times and 1.19 times higher, respectively [6]. Fujino et al. [7, 8] analyzed 110,000 data from a JACC Study and examined the association between educational background and leading causes of death. In the group with 15 years or less of education history, risk of death caused by cerebrovascular diseases after having adjusted for age was 1.23 times (men) and 1.44 times (women) higher than the group with 18 years or more of education history. After having adjusted for smoking, drinking, working situation, and job type, this relative risk was slightly decreased (decreased to 1.21 and 1.38 for men and women, respectively) [7, 8].

4 SES-Related Inequalities of Cerebrovascular Disease Risk Factors in Japan

In an analysis of the individual data obtained from the Comprehensive Survey of Living Conditions 2001, the population with lower SES tended to show many risk behaviors [9]. The income was divided into quintiles and the percentage of smokers was estimated according to group. Regardless of age, occupation, and area of residence, the smoking odds in the lowest income group were significantly 1.29 times higher than the highest income group. Furthermore, most of the behaviors that become the main cardiovascular disease risks were associated with income level: no exercise habit (odds ratio, 1.42), undesirable dietary habits (1.28), holding psychological stress (1.15), no experience of medical examination (3.14). Notably, there was no significant association with drinking.

The association between smoking and SES was also observed in a survey performed with 1361 public employees in Hyogo Prefecture in 1998. However, the association of SES with drinking (consumption every day or not) and exercise habit (moderate to high or mild and below) was unclear. For the biomarkers, the group with higher educational background and higher occupation stratum tended to show

significantly higher values for hemoglobin A1c, fasting blood glucose, triglyceride, and waist/hips ratio, and exceeded each diagnosis standard value for hypertension, hyperlipidemia, and diabetes [10]. In addition, the Aichi Gerontological Evaluation Study (AGES) (the early-stage project of the Japan Gerontological Evaluation Study: JAGES) performed with approximately 33,000 older people showed that the number of persons with the unfavored response for smoking and walking time was higher in the population with lower SES, by analysis of baseline data [11]. This study also suggested the presence of SES-related inequalities in medical access. According to the analysis by Murata et al. [12], the percentage of persons who responded that “I delayed the day of medical examination” was significantly higher in low-income persons. The common responses to explain this action were “cost,” “distance,” and “transportation” [12]. In addition, in a cohort of public employees in Toyama Prefecture, SES-related inequalities were related to psychosocial stress [13]. Thus, it was found that SES-related inequalities existed in cerebrovascular disease and its risk factors. However, for occupation stratum, associations between SES and risk factors were unclear in women (e.g., stress), while for some items, further examination is required (assay of SES and lifestyle risks and sex differences) [14].

Fig. 6.2 Mechanism hypothesis that low SES increase risk of stroke

5 Pathways Linking SES and Cerebrovascular Disease

5.1 *Material Poverty and Psychosocial Stress*

There are two possible primary pathways linking SES and cerebrovascular diseases: material poverty and psychosocial stresses (Fig. 6.2). In the material poverty pathways, risk is increased by material deprivation in the population with lower SES: access to goods and services for health maintenance may be poor; appropriate health information may be difficult to obtain; long working hours leave little time for leisure activities. Poor neighborhood environment may also contribute to the effect. For example, people living in impoverished areas may have difficulty in exercising safely because of public security or poorly maintained sidewalks, while access to vendors of fresh fruit and vegetables may be limited and access to cheap fast food may be easy [15].

For psychosocial stress pathways, persistent stress caused by low SES might promote risk behavior such as smoking and excessive drinking. Stress could also increase physiological risks directly. In a Korean large-scale cohort, after adjusting for conventional risk factors of stroke (smoking, exercise, height, drinking, serum cholesterol level, blood glucose level, hypertension, high body mass index, and place of residence), there was no change in the conclusions that a higher number of patients with cerebrovascular disorders were found in the population with lower SES [4].

The MONICA study of the World Health Organization followed 50 million people in 32 countries. During 10 years or more of follow-up, there were few changes in the distribution of classic cerebrovascular disease risks including blood pressure and serum lipids. However, analysis of data from Russia and Denmark, where significant economic upheaval occurred at the time, suggested that psychosocial stress caused by the macroeconomic crisis might contribute to death from cerebrovascular diseases, rather than conventional behavioral risks [4]. This potential direct influence of stress is known as “allostatic load” [16]. Persistent stress could affect the circulatory organs, immunity, and glucose metabolism and directly increase the risks of cardiovascular diseases.

The extent of load on the body from stressful daily life depends on the capacity to cope with stress, which could be a congenital trait or acquired after birth. In the AGES data, the population with lower SES showed lower ability to cope with stress. It was pointed out that subjective feeling of health is lower in such cases [11].

SES shows a health effect in each life stage from the period before birth up to adulthood. Accumulation of the impact may be expressed as biological and psychosocial risks [17]. It is likely that there are critical or etiologic periods that may have great influence on cerebrovascular disease risks. Understanding these periods is important to develop strategies for prevention with life course perspectives [18].

6 Policy Recommendations

6.1 *Monitoring SES Inequalities in Cerebrovascular Diseases*

Many societal conditions can change rapidly through globalization, financial crises, and decentralization. This makes the complete removal of health inequalities difficult, so discussion is required to determine which health inequalities are unacceptable and how they should be removed. Therefore, monitoring the magnitude and characteristics of diseases their risks across subpopulations and prioritizing the issues and subpopulations are important [19].

As mentioned in other chapters, a population strategy to design the social and built environments should be a primary measure to address health inequality. There is evidence on the efficacy of such interventions [20]. For example, price adjustment by taxation to cigarette and high caloric fast foods may be effective in reducing smoking and total calories consumed, weight loss, and glucose tolerance in the overall population [21, 22]. Health-promoting measures involving local residents are effective in raising health consciousness in the overall community and in building suitable infrastructure like sidewalks and parks [23].

From the “Dynamic of population statistics” by the Ministry of Health, Labour and Welfare. (1): Cerebrovascular disease indicates the total of cerebral hemorrhage, cerebral infarction, and other cerebrovascular diseases. (2): For subarachnoid hemorrhage, the data of other cerebrovascular diseases are reused. (3): The mortality from cerebrovascular diseases classified by illness has been listed in the vital statistics since 1951. Author’s note: The mortality from cerebrovascular disease has increased temporarily because of the issues for definition by application of ICD-10 in 1995.

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