GUIDELINES (JSH 2009)

Chapter 1. Epidemiology of hypertension

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POINT 1

1. The number of hypertensive people in Japan has reached approx 40 million.
2. The average blood pressure levels of the Japanese decreased markedly following a peak in 1965–1990. This decrease closely coincided with the decrease in mortality rate due to stroke in Japan.
3. Morbidity and mortality rates due to diseases such as stroke, myocardial infarction, heart disease and chronic renal disease increase with elevating blood pressure. The effects of hypertension are more specific to stroke than to myocardial infarction, and, in Japan, the morbidity rate due to stroke is still higher than that due to myocardial infarction.
4. From young through to elderly people, morbidity and mortality rates from cardiovascular disease increase with a increase in blood pressure level.
5. The risk of developing and dying from cardiovascular disease is 1.5–2.4 times higher in those with metabolic syndrome or multiple risk factors.
6. The mean salt intake of the Japanese still remains at about 11 g day⁻¹, and hence the state of a high salt intake persists. Reducing salt intake is extremely important for lowering blood pressure.
7. Hypertension is untreated in 80–90% of young hypertensive patients but should be attempted to be controlled through lifestyle modifications at least.
8. Hypertension is estimated to be insufficiently managed in about half of patients, and therefore stricter management is necessary.
9. In the Japanese population, a 2-mm Hg decrease in average systolic blood pressure has been estimated to lead to decreases of approx 6 and 5% in the morbidity rates due to stroke and ischemic heart disease, respectively. Environmental improvements to encourage the Japanese to adopt blood pressure control measures, including a reduction in salt intake, are awaited.

1) MORBIDITY RATE DUE TO HYPERTENSION AND THE NUMBER OF HYPERTENSIVE PATIENTS IN JAPAN

According to the 5th Basic Survey of Cardiovascular Diseases in 2000, 47.5% of Japanese men and 43.8% of Japanese women aged ≥ 30 years had a systolic blood pressure of ≥ 140 mm Hg or a diastolic blood pressure of ≥ 90 mm Hg, or were taking antihypertensive drugs, and the total number of hypertensive patients was approx 40 million.

Similar values were also reported in the quick report of the National Health and Nutrition Survey in 2006. The number of hypertensive Japanese is expected to increase further with the growth in the elderly population.

2) CHANGES IN AVERAGE BLOOD PRESSURE LEVELS OF THE JAPANESE

In Japan, with the successful management of infections following World War II, the age-adjusted mortality rate due to stroke increased rapidly and reached a peak in 1965. It then decreased rapidly until 1990, and the life expectancy of the Japanese became the longest in the world.¹ During this period, the morbidity rate from stroke decreased, contributing greatly to the reduction in mortality rate due to stroke, and the decrease in average blood pressure levels of the Japanese played an important role in these changes. According to the National Health and Nutrition Surveys, average systolic blood pressure levels of the Japanese increased from 1956, for which the earliest data are available, peaked at around 1965 and decreased in 1990 (Figure 1-1).¹ This decreasing tendency of blood pressure in the Japanese has also been shown by epidemiological surveys performed in Hisayama Town, Akita and Osaka.^{2,3}

3) HYPERTENSION AND THE OCCURRENCE AND PROGNOSIS OF CARDIOVASCULAR DISEASE

a. High incidence of stroke due to hypertension

The morbidity and mortality rates due to stroke increase with average blood pressure levels. Hypertension has a highly specific and close relationship with stroke, and, in Japan, the morbidity and mortality rates due to stroke are still higher than those of ischemic heart disease or myocardial infarction.¹ However, with the decrease in mortality rate due to stroke, the mortality rate from all heart diseases has become slightly higher than that due to stroke.

According to the Vital Statistics of Japan (2005), the age-adjusted mortality rate due to stroke was about three times higher than that due to acute myocardial infarction.¹ The morbidity rate from stroke was also four times higher than that from myocardial infarction in a morbidity survey of Okinawa Prefecture based on disease registration encompassing the entire prefecture.⁴ When the incidence rates of stroke and myocardial infarction in six Japanese cohorts aged 35–64 years were surveyed in 1989–1993, the incidence rate due to stroke was found to be 3–6 times higher in men and 4–12 times higher in women than that of myocardial infarction.¹

Stepwise positive correlations have been reported between hypertension and the morbidity and mortality rates from stroke.^{5–7} According to the subtype of stroke, cerebral hemorrhage was more closely related to blood pressure than cerebral infarction, but both showed

stepwise positive correlations with blood pressure. In the follow-up investigation of the Hisayama Study, a stepwise, strong positive correlation was observed between blood pressure and stroke (Figure 1-2).⁸ Furthermore, the incidence of lacuna infarction revealed a close correlation with the grades of hypertension shown in the Sixth Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC-VI), USA.⁷

Figure 1-1 Changes in the average systolic blood pressure of the Japanese by sex and age. Reproduced from Ueshima *et al.*¹

Figure 1-2 Incidence of stroke by blood pressure. Group 1 of Hisayama Study, men and women aged ≥ 60 years. Sex- and age-adjusted data of 580 people followed up over 32 years. Reproduced from Arima *et al.*⁸

The strong relationship between the JNC-VI blood pressure grades and mortality rate due to stroke was also shown clearly by NIPPON DATA80, in which a representative group of about 10 000 Japanese was followed up for 14 years.⁶

The relative risks of morbidity and mortality from stroke according to blood pressure, as indicated by follow-up studies in Japan and abroad, are also presented as data of Health Japan 21. According to these data, an elevation of 10 mm Hg in the systolic pressure increases the morbidity and mortality rates due to stroke by about 20% in men and about 15% in women.

Blood pressure is also related to stroke in the elderly, although the relationship is weaker than in young or middle-aged people. The relationship was clear, though weak, in a meta-analysis integrating many cohort studies in Western countries and Japan.⁹ Similar results were also obtained in the Asia-Pacific Cohort Studies Collaboration in a study summarizing the results for the Asia-Pacific regions.⁵ In the Asia-Pacific Cohort Studies Collaboration, the risk of stroke shows a log-linear association with the normal systolic blood pressure from the age groups < 65 years to ≥ 70 years, although the association becomes weaker in the elderly than in the younger group (Figure 1-3).

b. Development of heart disease due to hypertension

The relationship between hypertension and heart disease was similar to that between hypertension and stroke, although weaker. The results are similar when heart disease is specified as coronary heart disease. In men, morbidity and mortality rates due to coronary artery disease increase by about 15% with a 10 mm Hg increase in systolic blood pressure.

c. Hypertension and prognosis of chronic kidney disease

Patients with chronic kidney disease have a poorer prognosis and higher risk of stroke, myocardial infarction and total death with an increase in mean blood pressure. Blood pressure control alleviates kidney disorders and reduces cardiovascular risk in later life.¹⁰ In Japan also, cohort studies such as the Hisayama Study and NIPPON DATA90 have shown that cardiovascular morbidity and mortality risks are higher in those with a lower estimated glomerular filtration rate.^{11,12} In addition, NIPPON DATA80 indicated that those with positive proteinuria have an increased risk of death due to cardiovascular disease.

Figure 1-3 Risk of stroke against usual systolic blood pressure by age group. Reproduced from Lawes *et al.*⁵

d. Clustering of risks, metabolic syndrome and cardiovascular disease

The presence of a high morbidity rate due to cardiovascular disease in people with metabolic syndrome has been sufficiently established by epidemiological studies in Western countries. In epidemiological studies in Japan, morbidity and mortality rates from cardiovascular disease were 1.5–2.4 times higher in those with metabolic syndrome.^{13–16} These risks were also higher in those with more risk factors for metabolic syndrome.¹⁷ Moreover, NIPPON DATA¹⁸ and an epidemiological study in Ehime presented results suggesting the importance of an accumulation of risks regardless of the presence or absence of obesity,¹⁹ and NIPPON DATA¹⁸ reported results suggesting the importance of the presence or absence of abnormal glucose tolerance.

e. Relationship of average blood pressure with cardiovascular and total mortality risk at various age levels

Meta-analyses that integrated the results of many cohort studies at an individual level have revealed that cardiovascular morbidity and mortality risks increase with blood pressure levels in all age groups.^{5,9} NIPPON DATA80 also evaluated cardiovascular mortality risk by dividing the subjects into age groups of 30–64, 65–74 and ≥ 75 years, and reported that the relative risk was lower in the two latter groups than in the former group, but that the cardiovascular mortality risk increased with blood pressure category (Figure 1-4).²⁰ Moreover, a large meta-analysis incorporating cohort studies in Japan clarified increases in the total mortality rate with blood pressure level for both young and elderly people (Figure 1-5).²¹

f. Relationship of various blood pressure parameters with cardiovascular morbidity risk

As for the relationship between various blood pressure parameters and the risk of cardiovascular morbidity, systolic blood pressure has been shown to facilitate the most accurate prognosis and to be more closely related to cardiovascular disease than diastolic blood pressure or pulse pressure by a large meta-analysis encompassing cohort studies in the Asia-Oceania region.²² Cohort studies by Oyabe and Ohasama also reported similar results.^{23,24}

g. Prognosis of stroke

According to a World Health Organization joint study on the morbidity rates from stroke and myocardial infarction (MONICA), the case fatality rate in patients with stroke aged 35–64 years within 28 days of onset was about 30%, despite variation among groups.²⁵ On the basis of the registration of stroke patients in Japan around 1990, the age-adjusted case fatality rate in all patients within 28 days of onset was about 15%.^{4,26–28} Among stroke subtypes, the case fatality rate was highest for subarachnoid hemorrhage, being about 30%, followed by cerebral hemorrhage, about 20%, and cerebral infarction, about 10%. In the Hisayama study between the early 1970s and early 1980s, the case fatality rate within 1 year of the first episode of stroke reached 40% in patients aged ≥ 40 years.²⁹ The case fatality rate within 28 days was 25% in men and 22% in women.²⁹ According to the registration of stroke patients in Oyabe City (Toyama Prefecture), the case fatality rate within 28 days decreased by 21% in men and by 25% in women from 1980 to 1990.²⁸ The percentage of people who needed assistance due to impaired activities of daily living (ADL) 1 year after the onset of stroke was about 29–45%, indicating the extreme importance of the management of hypertension as a preventive measure against stroke from the point of view of the prevention of bed-ridden disability.

4) CHARACTERISTICS OF HYPERTENSION IN THE JAPANESE

a. High salt intake

An excessive intake of salt was one of the causes of the high prevalence of hypertension and stroke in the past in Japan. A high salt intake increases the blood pressure. INTERSALT showed by analysis of 24-h urine collection that blood pressure was high in groups with a high salt intake and that a positive correlation was present between salt intake and blood pressure in individuals.³⁰

Currently, the salt intake of the Japanese estimated by analysis of 24-h urine collection is approx 12 g day⁻¹.^{30–32} It is lower in women than in men in proportion to energy intake. According to INTERSALT, the estimated salt intake in Japanese women in their 20s was about 10 g in 1985,³⁰ and according to INTERMAP, the estimated salt intake in men aged 40–59 years by analysis of 24-h urine collection was about 12 g in 1997.³² In 240 working men aged 35–60 years surveyed

Figure 1-4 Relative risk of death due to cardiovascular diseases by age and systolic blood pressure level as indicated by NIPPON DATA80 (3779 men, 19-year follow-up).²⁰

Figure 1-5 Relationships between systolic blood pressure and total mortality by age and sex. Adjusted for smoking, alcohol intake and BMI. Meta-analysis of data from 70 558 men and 117 583 women followed up over 9.8 years.²¹

in 2000, salt intake estimated by analysis of 24-h urine collection was about 11 g.

According to the results of the National Health and Nutrition Survey in 2006, the daily salt intake of the Japanese was approx 11 g (12.2 g in men and 10.5 g in women), and hence the current average salt intake of the Japanese is considered to be 11–12 g day⁻¹.

With regard to the results of past analyses of 24-h urine collection, the estimated salt intake in the Tohoku District was as high as 25 g in the 1950s.

The target salt intake proposed by Health Japan 21 is <10 g day⁻¹ but no marked decrease has been noted during the past 10 years according to the results of the analysis of 24-h urine collection, and hence this target remains to be attained.^{30–32} Salt intake is high in East Asia, including Japan. Particularly, Na excretion per unit body weight determined by 24-h urine collection was high in China, Korea and Japan among the 52 groups in 32 countries of the world surveyed in INTERSALT.³³

A decrease in average salt intake affects the average blood pressure level of a given population. INTERSALT estimated that a decrease of 6 g day⁻¹ in salt intake would reduce the elevation in systolic pressure level after 30 years by 9 mm Hg.³⁰ DASH, in which the effect of the control of salt intake on blood pressure was evaluated, reported values similar to those estimated by INTERSALT.³⁴ Further efforts to reduce salt intake are necessary for controlling hypertension in Japan.

b. Changes in the degree of obesity and frequency of metabolic syndrome

Obesity is less common in Japan than in other advanced industrialized countries. However, body mass index (BMI, kg m⁻²), which is an index of obesity, is found to increase annually in men, whereas it is seen to decrease slightly in women until their 50s.

Regarding the characteristics of hypertensive Japanese, lean people with a very high salt intake account for a high percentage, but the number of obese hypertensives has increased recently, particularly in the male population.

In the United States, BMI has shown marked increases since 1990, and hypertension associated with metabolic syndrome is growing in significance. In Japan, mean BMI is about 23.5 kg m⁻², which differs markedly from that in the United States, where it is ≥ 28 kg m⁻².³² However, hypertension associated with obesity appears to be increasing in Japanese men.³⁵ According to the National Health and Nutrition Survey in 2006, the percentage of people strongly suspected to have metabolic syndrome was 24.4% of men and 12.1% of women, and the percentages of those at high risk were 27.1 and 8.2%, respectively.

c. Untreated hypertensive patients and poor management of hypertension

If a blood pressure of $\geq 140/90$ mm Hg is defined as hypertension, 80–90% of hypertensive patients in their 30s and 40s are untreated in Japan. These people must at least try to normalize their blood pressure through lifestyle modifications. In a survey of 6186 male and female workers aged ≥ 20 years performed at 12 companies in 2000–2001, about 70% with hypertension in their 30s were untreated.³⁶ Of the hypertensive men in their 40s and 50s, 44 and 39%, respectively, were untreated. At these companies, a high percentage of workers underwent annual health screening, but the percentage of those in their 40s and 50s who recognized that they were hypertensive was only 71–77%.

The Ohasama Study investigated the state of blood pressure control in patients undergoing depressor therapy. The results indicated that control of blood pressure was inadequate in about half of patients on the basis of either the routine outpatient blood pressure or home blood pressure measurement.³⁷ In addition, in a study of the state of treatment of those undergoing antihypertensive therapy by family doctors all over Japan on the basis of blood pressure measured at home (J-HOME), home blood pressure was in the hypertensive range in approx half of the 1533 hypertensive patients. In this study also, hypertension was poorly controlled in approx half of patients.

5) PREVENTIVE MEASURES AGAINST HYPERTENSION FROM THE POINT OF VIEW OF PUBLIC HEALTH

According to NIPPON DATA80, more than half of the deaths due to stroke occurred in patients with a blood pressure in a mildly hypertensive range or lower (systolic blood pressure <160 mm Hg and diastolic blood pressure <100 mm Hg).⁶ Therefore, it is more important to promote a reduction in the average blood pressure of the general population than specifically target only hypertensive patients.

Factors that affect blood pressure levels of the general population include age, intakes of salt and potassium, protein, calcium, magnesium and fatty acids, degree of obesity, alcohol intake and physical activity level. With the exception of residents of unacculturated areas, blood pressure increases with age, and an excessive salt intake is suspected to be a cause of this increase.³⁰ Salt intake is still high in Japan. Systolic blood pressure is expected to be reduced by 1–4 mm Hg through a 3-g decrease in daily salt intake.³⁸ In men, also, increases in the degree of obesity are considered to prevent decreases in average blood pressure.³⁵ A high alcohol intake in middle-aged men is also considered to be a factor preventing average blood pressure reduction.

Table 1-1 Estimated decreases in the numbers of patients having, dying from and suffering impaired ADL due to stroke, having, dying from ischemic heart disease and dying from cardiovascular diseases associated with a decrease in the systolic blood pressure (–2 mm Hg)

<i>Decrease in blood pressure (–2 mm Hg)</i>	<i>Stroke</i>	<i>Ischemic heart disease</i>	<i>Cardiovascular diseases</i>
Decrease in the number of deaths	9127	3944	21 055
Decrease in the number of patients	19 757	5367	—
Decrease in the number of patients suffering impaired ADL	3488	—	—

Abbreviation: ADL, activity of daily living.

Although genetic predisposition affects individual blood pressures, no genetic factor affecting the average blood pressure of the general population has been identified. (See inherited hypertension in Chapter 12.)

A decrease of only 1–2 mm Hg in the average blood pressure is known to markedly affect morbidity and mortality rates due to stroke and myocardial infarction.³⁹ Health Japan 21 collated the results of epidemiological studies in Japan and calculated expected decreases in morbidity rates from stroke and ischemic heart disease associated with decreases in the average blood pressure of the Japanese. According to this calculation, a decrease of 2 mm Hg in the average systolic blood pressure is expected to reduce morbidity rates from stroke and ischemic heart disease by 6.4 and 5.4%, respectively. It is also expected to reduce the number of deaths due to stroke by about 9000 and

the number of patients with an impaired ADL level by about 3500 (Table 1-1). The decrease in the number of deaths due to ischemic heart disease will be about 4000.

To reduce the average salt intake of the population, intensive guidance to follow a low-salt diet is required. However, INTERMAP showed that the actual reduction in salt intake in those who were following a low-salt diet was about 1–2 g day^{–1}. Therefore, hypertensive patients and others who need to reduce their salt intake should create an environment in which they can readily comply with a low-salt regimen. In addition, to reduce average blood pressure, it is necessary to create an environment in which many people spontaneously reduce their salt intake.

In Japan, nutritional labels on foods mention only some nutrients and additives, and labeling related to the content of salt and other necessary nutrients is not obligatory. In addition, if the Na content is indicated, the equivalent salt intake is not, and there is no mention as to what percentage of the daily allowance the salt content of the food accounts for, whereas this is indicated in labeling in the United States. These measures are extremely important for managing hypertension.

Citation Information

We recommend that any citations to information in the Guidelines are presented in the following format:

The Japanese Society of Hypertension Guidelines for the Management of Hypertension (JSH 2009). *Hypertens Res* 2009; **32**: 3–107.

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