Standard Blood Pressure Curves of Schoolboys and Schoolgirls in Akita Prefecture

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OKAMURA, T., TAJIMA, H., IIJIMA, Y., GOMI, H., TOMINAGA, S., NISHINARI, H. and OYAMADA, T. Standard Blood Pressure Curves of Schoolboys and Schoolgirls in Akita Prefecture. Tohoku J. exp. Med., 1981, 135 (4), 419–422. — Blood pressure of 251,742 schoolboys and schoolgirls aged 7 to 18 years was measured in the year 1970. Analyzing these data, the authors obtained the percentile values classified by age. The lowest hypertensive systolic blood pressures, which are represented by the 95th percentile, are 123, 126, 128, 128, 129, 134, 138, 144, 149, 152, 155, and 154 mmHg in boys from 7 to 18 years of age, respectively. The corresponding values are 123, 126, 128, 130, 134, 138, 139, 143, 144, 142, and 141 mmHg in girls of the same ages. Girls' systolic blood pressure is higher than that of boys between the ages of 10 and 13 years. After the 14th year of age, girls' systolic blood pressure does not increase any further, whereas boy's blood pressure continuously increases until 18 years. The present results differ in the following two points from the study in USA (1977): 1) The uniform rise of blood pressure with age is not observed. 2) Blood pressure, especially systolic pressure, is higher in girls than in boys between the ages of 10 and 13 years, although it is higher in boys thereafter until 18 years.

Akita Prefecture is situated in the northern part of Honshu Island of Japan. This district is notorious for a high incidence of cerebral stroke (Daiwa Health Foundation 1978). By the epidemiological survey, hypertension has been established as the most important cause of stroke (Hirota and Katsuki 1976). The high incidence of both hypertension and stroke has been our serious concern. Akita Medical Association has devoted its efforts over the past 10 years in the collection of sufficient data on blood pressure levels of school children. The standard blood pressure curves in children obtained by the National Heart, Lung and Blood Institute, USA (1977) are well known. Similar reports, however, seem to be lacking in Japan. In this paper, the blood pressure values collected by our Association were analyzed to obtain blood pressure percentile curves.

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SUBJECTS AND METHODS

Subjects were divided into two groups according to the age. One consisted of 198,122 children (aged 7 to 15 years) of both elementary and junior-high schools covering the whole Prefecture in the year of 1970. The other consisted of 53,620 students of senior-high schools (aged 16 to 18 years) covering the whole Prefecture in the same year.

Mercury sphygmomanometers, membrane-type stethoscopes and two kinds of manchettes, 9 and 12 cm in width, were employed depending on the physique of children for the measurement. Manchettes of 12 cm width were applied to the senior-high school students. The diastolic pressure was determined by the fourth Korotkoff phase. Three consecutive measurements in the sitting position under resting conditions in the morning were performed in September and October when the climate was comfortable. The lowest value of the three measurements was recorded for both systolic and diastolic pressures.

As blood pressure in the childhood, unlike in the adult, is under the influence of physical growth, it is not easy to establish the criteria for the diagnosis of hypertension (Voors et al. 1978). To judge whether an individual blood pressure of children is hypertensive or not, it is necessary to know how this value deviates from the majority. We therefore calculated percentile values which indicate the position in the distribution of the whole collected values (Voors et al. 1978). The percentile values in each age group were calculated using the data reported by Fujiwara (1970), and based on this calculation the standard curves of blood pressure were obtained. In these curves, blood pressure levels exceeding the 95th percentile are considered to be hypertensive (National Heart, Lung and Blood Institute, USA 1977), while the values between the 90th and 94th percentiles are on the borderline.

RESULTS

Fig. 1 illustrates standard curves of blood pressure of schoolboys and schoolgirls between the ages of 7 and 18 years. The systolic blood pressure was

Fig. 1. Percentile curves of blood pressure in schoolboys and schoolgirls.
higher in girls than in boys between the ages of 10 and 13 years. No further increase in systolic blood pressure was observed in girls after 13 years of age, whereas in boys it persistently increased up to 17 or 18 years of age. The systolic blood pressure of boys exceeded that of girls after 14 years of age. The diastolic blood pressure showed similar changes, though less prominently.

COMMENTS

Blood pressure was reported to rise with the growth from childhood toward adulthood (Voors et al. 1978). Essential hypertension was considered as a disease developing in adults. Recent progresses in the pathophysiology, however, have suggested that the blood pressure level in childhood is an important factor for the development of essential hypertension. Thus, the incipience of this disease has been traced back to childhood (Holman 1961).

According to the report from the National Heart, Lung and Blood Institute USA (1977), blood pressure rises uniformly as age advances after the age of 7 years and systolic blood pressure is always higher in boys than in girls of the same age. Our results (Fig. 1) are different in the following two points from the US report (1977): 1) The uniform rise of blood pressure with age is not observed. 2) Blood pressure, especially systolic pressure, is higher in girls than in boys between the ages of 10 and 13 years, although it is higher in boys thereafter until 18 years.

The levels of blood pressure seem to vary largely depending on race, sex, age, generation, nutrition, culture, and so forth (the Fifth Hahneman International Symposium on Hypertension 1979). Among these, dietary salt intake appears to be the major factor for the elevation in blood pressure level (Gleibermann 1973). Since blood pressure rises with age especially in children, percentile values of blood pressure are necessary to evaluate the individual blood pressures. We regarded the values which exceeded the 95th percentile as hypertensive, while the values between the 90th and 94th percentiles to be on the borderline. The pattern of the percentile curves, however, seems to be different in Japan and the USA (National Heart, Lung and Blood Institute 1977). In practice, it should be kept in mind that a single value higher than the 95th percentile obtained from an apparently healthy child does not necessarily mean a pathological state. It is necessary for the clinical evaluation to repeat the measurements at times to observe the trend of blood pressure levels.

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References


