Facts and Fallacies Regarding the Blood Pressure of Different Regional and Racial Groups

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The blood pressure cuff reveals higher values in complex societies than in simpler social environments. Evaluation of the importance of this fact necessitates a more exact use of such terms as "high blood pressure" or "hypertensive disease" as applied to an individual, and "mean blood pressure" or "incidence of hypertension" as applied to groups. The inadequacies of the cuff method of blood pressure determination are particularly evident in group studies. From the available facts, a few cautious conclusions may be drawn.

The blood pressure of people of so-called primitive cultural environments has been reported to be lower than that of people in more complex societies.1-17 Negroes in the United States have a higher blood pressure than the whites,18-35 while Negroes in Africa1-2, 15-17, 36-37 and Chinese in China4-7, 9, 38-45 have been reported to have exceptionally low blood pressure. These facts, if true, should be of importance in evaluating current concepts of the etiology of hypertension. The authors' findings in Panama confirm earlier reports46-48 of a high incidence of hypertension in the Negro population and a moderate to low incidence among the whites and Panamanians. The literature was reviewed in an attempt to correlate the data from Panama with the prevailing views regarding the blood pressure of different racial and cultural groups. This review revealed variables and discrepancies usually not considered in earlier studies, which cast doubt on the generally accepted concepts mentioned above. Full consideration has been given to these variables in the presentation of the accompanying material which has, of necessity, been obtained mostly from the reports of other investigators. Only those data which should reflect the relative blood pressure of distinct racial, geographical, economic, sociologic, or cultural groups have been used.

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Reliability of Data

There are many pitfalls to be avoided in interpreting comparative blood pressure data. As many of these as possible were determined and considered, although, unquestionably, there were others which were not recognized.

The manner of determining and reporting blood pressure in these studies has varied with the type of apparatus used, the size of the arm cuff, the method of determining the systolic pressure (auscultatory or palpatory), the change of tone or disappearance of all sounds selected as indicating the diastolic pressure, the care with which basal pressure was determined, and other factors. Age, weight, sex, and other factors known to affect blood pressure were not always reported. In few reports could it be determined whether the hypertension reported was "essential" or otherwise. Although Smith50 showed that in the United States high blood pressure is only rarely due to renal disease, this is not necessarily true of other groups of people.

The terms "high blood pressure" and "hypertensive disease" are not synonymous. The difference may be much greater than is ordinarily indicated. It is not necessarily true that the pathologic changes frequently associated with hypertension are due to the elevated blood pressure because it is known only that under most conditions these changes and high blood pressure are concomitant variables. Snapper51 has reported "hypertensive disease" in Chinese with "normal blood pressure." In interpreting Snapper's observations, it is important to know
that due to variations in the size of the arm, blood pressure by the auscultatory method varies 60 mm. Hg as compared with the true blood pressure obtained by intra-arterial cannulation. This fact has been ignored by other investigators in evaluating the blood pressure of different groups of people.

The term "blood pressure" alone when applied to a group means little. In order to compare relative values in different groups, it is necessary to choose one factor to which the various terms for blood pressure can be converted. Blood pressure for a group may be expressed in the following ways: (1) Mean blood pressure: the arithmetic mean of all blood pressures. (2) Mean normal blood pressure: the arithmetic mean of all blood pressures except those that are "abnormal." (3) Incidence of "hypertension": the frequency of hypertension as a clinical or pathologic entity. Each of these expressions has objectionable features. "Mean blood pressure" varies greatly with the number of "hypotensives" or "hypertensives" included in the series. On the other hand, "mean normal blood pressure" can be low although the incidence of "hypertension" is high. Since arbitrary criteria for "hypertension" based on blood pressure determinations are not applicable to different groups, statements regarding "mean normal blood pressure" have little meaning. For these reasons, it was felt that the most desirable data was the "incidence of hypertension."

Unfortunately, it was impossible to use only the reports that could be converted to one factor and still have adequate material from which to draw conclusions. Consequently, comparisons were made of mean blood pressure with mean blood pressure, incidence of hypertension with incidence of hypertension, and mean normal blood pressure with mean normal blood pressure. When adequate collateral data such as age, sex, weight, and method of determining blood pressure were included in the reports, the error in the comparison was believed to be small. The likelihood of error was decreased by indicating only how one group compared with another and using only comparative terms such as "higher," "lower," or "comparable" instead of numeric values. Considering these points, extensive summary tables of quantitative data were omitted from this report. It was usually impossible to analyze the data statistically.

**Caucasians**

Thorough studies in the United States giving mean blood pressure, mean normal blood pressure, and incidence of hypertension for age, weight, and sex were used for comparison with other reports. They were compared first with people of predominantly white stock living under circumstances differing markedly from those in the United States. Indian insurance applicants in India, Indian laborers in Upper Assam, and white men in the Virgin Islands had mean blood pressures comparable to the figures for inhabitants of the United States while Arabs in the Euphrates Valley and Indians in Calcutta had relatively low values. Charity hospital patients in Egypt had a low incidence of hypertension while private patients had a moderate incidence compared with that in the United States. Indians in the Royal Air Force in India had lower mean blood pressure than the British under the same circumstances but were also much lighter in weight.

A number of authors have suggested that the blood pressure of whites in the tropics and the Orient is lower than the pressure of white persons living in other climates. Mason has summarized this subject and concludes that there was a slight tendency toward lowering of blood pressure in tropical climates but that individual variation was very great. Many of these reports were based on data from the Philippines. Siler found an apparently lower blood pressure in the Philippines, but when he corrected for weight found no difference for those 10 or more pounds overweight. Harris questioned Foster's observations in China on the basis of life insurance statistics. Harris felt that the mean blood pressure level and incidence of hypertension of Americans and Europeans in China were comparable to those found in Western countries. Others have also failed to find a tropical climate to have any significant effect on blood pressure.
Mongoloids

Chinese. Low mean blood pressures as compared with that of inhabitants of the United States have been consistently reported for the Chinese in China 6, 7, 9, 38-42 Japan 81 and Formosa. 82 Krakower 83 found values for Chinese in Canada to be lower than the United States figures but higher than for Chinese in China. Hunter 84 and Tung 85 found a relation similar to that found by Krakower between the values for Chinese in the United States and Chinese in China. Ling 86 in extensive data on insurance applicants found the mean blood pressure of the Chinese in China to be comparable to that in other reports on Chinese, but his incidence of hypertension was surprisingly high. The low mean blood pressure in the presence of many hypertensives was due to a large number of hypertensives (2.26 per cent had blood pressure below 90/60) and quite likely to a lower mean normal blood pressure.

Ling's interpretation of the phenomenon of low blood pressure in China and high blood pressure in North America, based on the marked difference in the weights of the two groups, warrants more attention. For a given age and height, the mean body weight of Westerners is 11 to 23 pounds (10 to 20 per cent) greater than that of Chinese in China. Ling demonstrated a progressive increase in mean blood pressure with increasing weight when his material was divided into four groups according to the relation of the weights of his subjects to the mean weight for Chinese. Symond's figures for mean blood pressure in the United States are lower than for Ling's most obese group but higher than all other groups.

When Symond's figures (10 to 20 per cent overweight by Chinese standards) are compared with Ling's group 3 (20 to 40 per cent overweight by Chinese standards) and both are grouped according to age, the differences between the blood pressures are insignificant. Ling stated that contrary to the general belief that the blood pressure of the Chinese is 20 to 30 mm. Hg less than that of Westerners, the systolic is only 5 to 13 mm. lower and the diastolic is only 4 to 8 mm. lower. Ling calculated the incidence of hypertension (blood pressure greater than 150 systolic and/or 100 diastolic) for only two groups: those overweight ("other than the standard") and those underweight. Of those overweight, 21.8 per cent had hypertension in contrast to only 0.1 per cent of those underweight. Ling concluded, "It is not my intention to claim that lighter body weight is the sole factor in the causation of relative hypotension in Chinese. Nevertheless, the results seem to indicate that relative underweight is the most important and certain factor."

Ling's conclusion must be accepted, but other factors which vary concomitantly with weight (such as social and dietary habits and emotional factors) may also play a role in the incidence of hypertension. However, of unquestionable importance is the fact that blood pressure as determined by the cuff method becomes greater with increasing circumference of the arm.42-53 This fact appears more important in view of Snapper's54 observations of hypertensive disease in Chinese in the absence of notable elevation of blood pressure. He pointed out that hypertensive disease was not rare in China and the symptomatology as regards heart failure, cerebral hemorrhage, and eyeground changes (he included reports of malignant hypertension) was the same as is seen in the West. The only differences were the relatively low blood pressure and the lack of arteriosclerosis and myocardial infarction. He found that hypertension was the most frequent cause of cardiovascular disease in the older age groups.

Wang44 had a similar experience. He described 58 cases of "essential hypertension" seen in the Hsiang Ya Hospital in Changsha over a period of three years. All but two of these had complications which were responsible for their admission to the hospital. 80.2 per cent had cardiac enlargement. Half of these had cardiac decompensation. The high incidence of complications suggests the possibility of many others having hypertension which was undetected because the blood pressure was not determined routinely or because of the inadequacy of the cuff method. He states, "Hypertensive cardiovascular disease is a fairly common clinical occurrence." It is unfortunate that extensive postmortem material is unobtainable.
in China since it would help clarify the true incidence of hypertensive disease.

In general, the data support Ling's contention that weight is the most important variable which has been detected to account for the differences in the recorded blood pressure of Chinese and Westerners in either the West or China. It must be added that in the authors' opinion, the mechanical error in the determination of blood pressure by the indirect method in persons of widely differing arm circumference is the most certain factor responsible for this correlation.

Since differences in body build do not appear to account for all of the differences in mean blood pressure reported for Chinese and Westerners, other factors are probably involved. Moreover the mechanical error in blood pressure determination by the cuff method may not explain all of the correlations found between mean blood pressure and body build. Thus obese people may prove to have a higher mean blood pressure, even when determined by arterial cannulation. Even if this is found to be so, it could not be concluded that obesity and hypertension are causally related since a common factor may be inducing both conditions.

**Other Mongolid People.** Reports of mean blood pressure for Koreans, Marshall Islanders, Caroline Islanders, Eskimos, Zuni Indians, Mexicans, Yucatecans, Guatemalans, Panamanians, San Blas Islanders, and Puerto Ricans indicate lower values than for those living in the United States. Most reports indicate a moderately high mean blood pressure for the Japanese. However, Hunter found the Japanese to have lower mean blood pressure in Japan than in the United States. One of the present authors has seen definite cases of hypertension with characteristic retinopathy in rural Mayan villages of Guatemala. Most of the above reports fail to give data relative to the age-height-weight relationship of these people. However, since all the difference between the blood pressure values for Chinese and those for people of the United States could not be accounted for on the basis of body build, it appears that mean blood pressure of Mongoloids is lower.

**Negroes**

It is unfortunate that most of the references indicating low blood pressure in Africa are without supporting data. When these are eliminated most of the other reports indicating low blood pressure are from Kenya.

Donnison's findings are the most frequently quoted. That his data are not representative of the Negro in all of Africa is obvious from some of the subsequent reports. Donnison apparently took exceptional precautions to obtain the lowest possible blood pressure in his subjects. Each subject prior to determination of the blood pressure had an examination, "to exclude any condition that might influence blood pressure." The mean blood pressure thus determined was comparable to the United States values for subjects under 40 years, but much lower than United States values for older men. The fact that the younger men were recruits for labor while a tour of native reservations was necessary to find a sufficiently large number of older subjects may possibly explain this result. Donnison mentions that, "nervous subjects not uncommonly had systolic pressures over 200 temporarily," but that, "it was very uncommon to see systolic pressures greater than 144 that persisted." The low mean blood pressure reported does not exclude a moderate incidence of hypertension since we do not know the mean normal blood pressure for these people or the number of "hypotensives."

Jex-Blake saw only one case of cerebral hemorrhage (this case was attributed to syphilis) in 1100 autopsies in Kenya and concluded that hypertension must be rare. Vint found from postmortem material that all cardiovascular disease caused only 5.6 per cent of deaths. Heimann and co-workers found a low incidence of hypertension in a clinical and postmortem study of 120 cases of heart disease in Negroes in the city of Johannesburg, but blood pressure determinations were not made in all cases and the criteria for autopsy diagnosis were not given. Becker, later, in a careful study of postmortem material, revealed an unquestionably high incidence of hypertension in Negroes in Johannesburg. Brock also felt that obesity and hypertension were probably more common in Cape Colored females than in European females.
Several reports from other parts of Africa indicate a high incidence of hypertension. Dubois10 found high blood pressure levels in a "primitive" village of the Belgian Congo, but in his recent book102 commented, "Hypertension is rare in the tropics." In so doing he mentioned the prevailing view because he regarded the matter as unsettled.103 Beheyt,104 working in the Belgian Congo, considered the incidence of hypertension to be high in Leopoldville. Williams16 reported a high incidence of hypertension in Ugandi, but in a later study17 of 66 hospital cases found that all but 16 had syphilis, gonorrhea, nephritis, or polycystic kidneys. It seems unlikely that these conditions could have accounted for more than a small percentage of the hypertension previously reported. Colyer105 found a high incidence of hypertension in Northern Rhodesia.

As noted above, most reports from Africa indicate a high incidence of hypertension with the exception of those from Kenya. It should be pointed out that the population of Kenya has contributed little to the ancestry of the Negroes in the New World who are, for the most part, descendents of West Africans. The Negroid people of Kenya are mixed with the Hamitic people, a linguistic rather than racial group, who are of mixed black and white stock.

Hicks and Matters,4 and Nye11 reported low blood pressure in Australian aborigines, but Hicks and Matters pointed out that in their study the weight varied from 42 to 63 Kg. They also commented on the poor state of nutrition.

Many reports,18-25,49 confirm the high incidence of hypertension found in the Negro in the New World. It is higher than in the whites in the same area in every instance.

The situation in Panama is so unique that it deserves discussion. Several observers using different methods have noted the blood pressure to be high in Negroes and moderate to low in whites and Panamanians.46-49 Marvin and Smith87 pointed out that of patients admitted to Gorgas Hospital in the Canal Zone with hypertensive cardiovascular disease as their primary condition, 94.1 per cent of Panamanians and 83.3 per cent of West Indians had abnormal urine. Thirty per cent of Panamanians and 17 per cent of West Indians had elevated blood nonprotein nitrogen. Taylor69 in a study of autopsy material found that of subjects with hypertension, 12 per cent of Negroes and 18 per cent of whites had normal kidneys while all Panamanians had some type of nephritis. Taylor interpreted this as suggesting that the Negroes do develop essential hypertension while the Panamanians may not since all had nephritis.

The cases studied at Gorgas Hospital are composed of Panama Canal and Panama Railroad employees and their families. The Negroes and Panamanians work under comparable circumstances and wage scales. Their diets do not differ significantly according to careful survey.107 Neither group is characterized by either obesity or undernutrition although we have found Negro women attending the prenatal clinic of Gorgas Hospital to be larger and heavier. Their fundamental personality type has never been systematically evaluated, but they differ in that the Panamanians are native citizens of Panama while the Negroes studied were brought in from the West Indies as temporary charges of the United States Government, and were neither natives nor citizens of either Panama or the United States.

How all this affects the Negro psychologically cannot be stated; but to postulate that environmental and cultural factors are the major cause of their higher blood pressure would require demonstration of a low incidence of hypertension in Africa, where the Negroes are in a position somewhat comparable to the Panamanian in Panama. However as mentioned above, the reports of Becker,102 Coyler,105 Dubois,101 Brock,104 and Williams16 establish that African Negroes do have considerable hypertension, even when in their native state.14,101,105

Since differences in body build do exist between Negroes and Panamanians, this factor probably accounts for part of the differences in average blood pressure observed. Although psychologic and social factors may account for some of the difference in incidence of hypertensive disease between these racial groups, it is at least equally probable that genetic factors are of primary importance.
COMMENT

In an effort to determine the validity of the beliefs regarding the comparative blood pressure of people living in so-called primitive and civilized environments, reports that might clarify the problem were collected and analyzed. This material is difficult to evaluate because the studies fail to control all of the variables known to affect blood pressure.

One major variable in particular, change in arm size with change in body weight and its effect in increasing or decreasing the blood pressure reading obtained by the cuff method, undoubtedly influences much of the recorded data. The intra-arterial blood pressure is the only satisfactory measure for comparing the blood pressure of people of differing weights. For these reasons, future studies of "normal" blood pressure, fall in blood pressure with starvation, amelioration of hypertension in the obese with weight reduction, the benign course of hypertension in the obese, and differences in blood pressure with age and sex, of prisoners and prison guards, of rural and urban people, and in different disease states should include data referable to the size of the arm and intra-arterial values when possible.

Until more is known of the relation of blood pressure and hypertensive disease, a normal range of blood pressure will be difficult to define and direct comparison of blood pressure values in different groups may not correctly indicate the relative incidence of hypertensive disease.

Despite the many difficulties in interpreting such data some cautious conclusions can be drawn. Certainly people in very simple social environments sometimes have hypertension. Most of the other conclusions that have been drawn regarding differences in blood pressure of different groups of people must be considered to be poorly substantiated because of a failure to consider pertinent variables. There does appear to be a racial difference in blood pressure values which cannot be accounted for entirely by the variables which were considered. Even this difference, however, may not be due to genetic factors since the members of a race, regardless of where they are, may retain cultural traits or be subjected to environmental stresses which cause an increase or decrease in blood pressure.

Conclusions

1. If proper consideration is given to known variables, the evidence to prove that geographic or cultural environments have a significant effect on the incidence of essential hypertension is inadequate.

2. While the data show that racial differences in the incidence of hypertension do exist, they do not suffice to indicate the relative importance of genetic, psychologic and social factors.

3. Much more uniform and exacting methods for studying and reporting the blood pressure of groups are needed in future epidemiologic studies of blood pressure.

SUMARIO ESPAÑOL

El esfigmanómetro revela valores más altos en sociedades complejas que en ambientes sociales sencillos. La evaluación de la importancia de este hecho demanda un uso más exacto de términos como "alta presión arterial" o "enfermedad hipertensiva" cuando se aplican a un individuo y "presión arterial promedio" o "incidencia de hipertensión" cuando se aplica a grupos. Lo inadecuado de las determinaciones de presiones con el esfigmanómetro de boca-manga es particularmente evidente en estudios de grupos. Algunas conclusiones cautos se pueden desprender de los hechos asequibles.

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