Ethnic differences in hypertension and blood pressure control

Issues for prevention strategies

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ABSTRACT

Population studies revealed significantly lower levels of hypertension among rural community than both semi-urban and recently urbanized communities, and much of the difference was attributed to environmental factors. Migration studies revealed that increased sodium consumption is a key factor for the development of hypertension in some ethnic group, and people of African origin are known to be more prone to develop hypertension in western countries. Recent data obtained in European countries reveals that the rates of detection, treatment, and control are higher among the black population indicating a greater awareness among the general public and physicians in Europe of the importance of detecting and managing hypertension in blacks. However, due to the relevant role of the environment and increasing urbanization, the greater attention to prevention strategies should be placed in developing countries to prevent the onset of global epidemics. Primary prevention of hypertension is possible through weight reduction, regular exercise, salt restriction and other dietary measures, but in developing countries is specially important to identify groups where a particular intervention is more effective and to improve detection and control of hypertension.

In practically all epidemiological studies examining blood pressure profiles ethnicity is based on self-report which indeed confounds the identification of ethnic specific factors, genetic factors, in the admitted population. Notwithstanding, this limitation several epidemiological studies performed in western countries reported substantial ethnic differences in cardiovascular disease and revealed that African-Americans are more prone than whites to develop hypertension.[1] In blacks hypertension occurs more frequently,[2] and consequently strokes are more common, end-stage renal failure is up to 20 times more frequent than in non blacks,[3] and the prevalence of left ventricular hypertrophy is two fold higher when compared to non-blacks with comparable blood pressure levels.[1] Similar findings have been more recently obtained also in Europe.[4,5] In Europe a different ethnic group, south Asians, defined as people originating from the Indian subcontinent and East Africa, seems to be more prone to coronary artery disease. In particular the high incidence of myocardial infarction in south Asians[5] is closely related with the high incidence of diabetes[4] (**Figure 1**). The high prevalence of hypertension in blacks is probably responsible for the high risks for stroke in this subgroup whereas south Asians have a more pronounced risk of coronary artery disease when compared to whites and blacks.[6] However, both south Asians and blacks are more prone than whites to develop renal disease in Europe and the requirement of dialysis

procedures in these ethnic subgroups is growing.[7] The high prevalence of hypertension in blacks living in western countries is likely undue only to ethnicity as rural populations living in Africa have lower blood pressure values than caucasian english people.[8] Indeed, urbanization is associated with deep changes in risk factor distribution.[9] Different studies performed in India between 1949 and 1998[10-24] revealed that modernization has been associated with a progressive increase in the prevalence of hypertension among people resident in urban but not in rural districts[25-30] **(Figure 2)**. Hypertension is a major risk factor for cardiovascular and cerebrovascular disease, the major causes of death in western countries. In recent years major changes in the health profile of many developing countries are taking place especially as life expectancy is increasing, and people are more exposed to diseases of old age like hypertension and cardiovascular diseases. Therefore, today also in developing countries the burden of deaths and disability caused by cardiovascular diseases is gradually outweighing that imposed by long standing communicable diseases. Environmental factors were shown to have some influence on the development of hypertension in the United States of America (USA). However, in the USA race if often a surrogate for many social and economic factors that influence health status and healthcare delivery so that poor outcomes in ethnic minority groups occur in many diseases, not only hypertension.[31] Therefore, to better clarify the relationship between environmental and genetic factors useful information can be obtained from the studies investigating people who migrate from the country of origin to a country with different dietetic habit. Information obtained with this approach might be useful to plan strategies in countries, which experienced urbanization in recent years.

Migration studies and pathophysiological issues. Population studies revealed significantly lower levels of hypertension among rural community than both semiurban and recently urbanized communities, and much of the rise in blood pressure levels was attributed to environmental factors. In a community of jordanian aborigines in northern Jordan, the prevalence rate of hypertension was 10.9%, significantly lower than the 16.1% and 16.3% prevalence rates reported from other more modernized jordanian communities.[32] More defined information regarding the role of the environment can be obtained from migration studies. Four prospective studies performed on blacks migrating to New Zealand,[33] Kenya,[34] Israel,[35] and Italy[36] showed the relevance of changes in dietetic habits. In the first one,[33] the migration of Tokelau islanders to New Zealand was associated to only a minor blood pressure increase with only a slight increase in sodium intake. In the second study,[34] performed
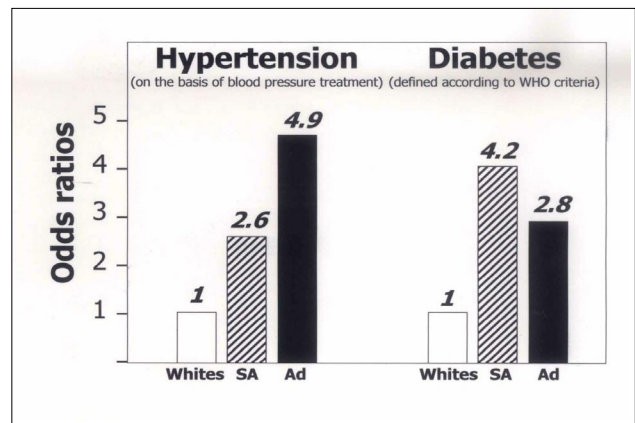

Figure 1 - Odds ratio for hypertension and diabetes in south Asians (SA) and in African descendents (Ad) in the Whitehall study, a cohort study of London based population (n=10,308) (adapted from 4).
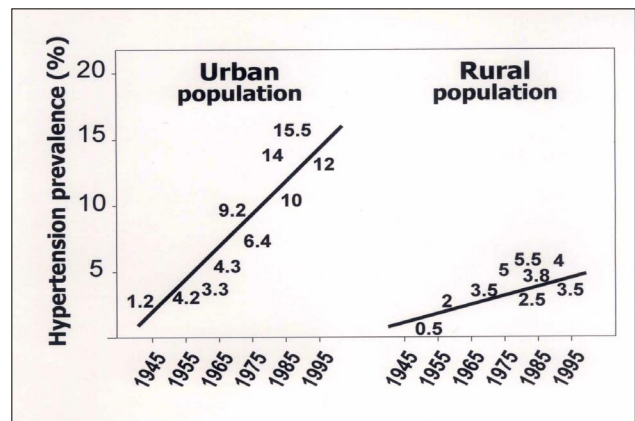

Figure 2 - Different hypertension prevalence trends in urban and rural indian populations (adapted from 10-24).
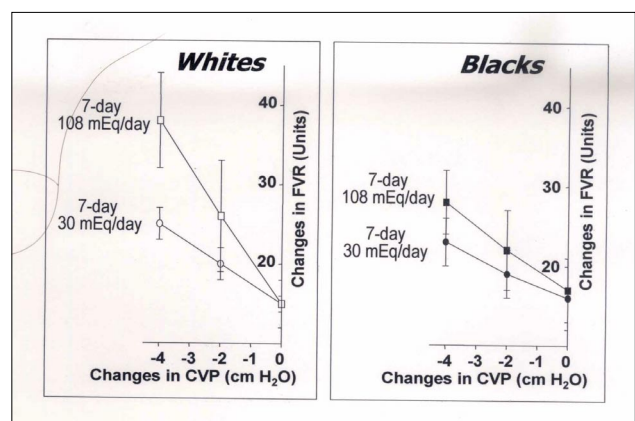

Figure 3 - Impaired adaptation of peripheral resistance to volemic changes in blacks is related with an impaired sensitivity of cardiopulmonary reflex system (adapted from 37).

on migrants from a remote Kenyan low blood pressure community to an urban centre, the greater blood pressure increase was associated with an increase in sodium intake, in body weight, in smoking and in alcohol intake. In Ethiopian immigrants to Israel, other factors, such as initial blood pressure values, gender, age and weight gain, significantly affected blood pressure at the one-year follow up.[35] A longitudinal study investigating the effects of migration from Somalia to Italy (Florence)[36] was performed in a homogeneous population of black normotensive subjects, and other confusing factors, such as changes in body weight, smoking, and alcohol intake were ruled out. After a 6 month stay in Florence, all the blacks were employed and no significant changes in body weight, smoking habits or alcohol intake were observed. All subjects were normotensive at enrollment but at the 6 month follow up 30% of them had hypertension with blood pressure values higher than 140/90 mm Hg. An increase in plasma cholesterol was present, but no significant weight gain was found. Conversely, sodium intake was significantly increased (from 97 ± 16 to 165 + 33 mEq/day) with a significant increase in plasma volume. The increased blood volume was indeed associated with increased venous tone and higher than baseline systolic pressure at night time as revealed by 24-h blood pressure monitoring.[36] The effect of diet seems to indicate a close link between genetic and environmental factors. Indeed, black immigrants were also shown to have a reduced sensitivity of the afferent pathway of the cardiopulmonary reflex with resultant defective inhibitory afferens to the sympathetic outflow.[37] This altered response makes them unable to adapt peripheral circulation to increased blood volume. Indeed, the efficiency of the cardiopulmonary reflex system did not differ between Caucasian and blacks at low sodium diet, whereas when sodium intake was increased blacks showed a defective modulation of cardiopulmonary reflex system (**Figure 3**). The impaired adaptability of the efficiency of cardiopulmonary reflex system seems to compromise the ability of blacks to adjust peripheral circulation, when blacks are exposed to a normal western diet. Therefore the increased sodium sensitivity in blacks is associated with a defective sensitivity of the cardiopulmonary reflex which impairs the hemodynamic adaptive response to blood volume increase and favor the development of a neurohumoral excitatory state. The higher serum creatinine levels, increased protein excretion, and increased incidence of end-stage renal failure reported to occur in black patients might be also closely related with sodium sensitivity. When salt sensitive patients are challenged with a high sodium diet, the blood pressure rises to a greater degree than in the salt-resistant state. Whilst the glomerular filtration state remains the same, renal blood flow rises in the salt resistant patients and fall in the salt sensitive blacks.[38] It has therefore been suggested that this rise in filtration fraction and intraglomerular pressure during high sodium intake might, in part, explain the increased incidence of renal complications in salt sensitive black hypertensives.

Clinical implications. Black populations seems to respond differently to certain antihypertensive drugs when compared to caucasian patients. Randomized controlled trials have shown that diuretics reduces hypertension related morbidity and mortality in blacks as well as in caucasian population but there is evidence of a greater decrease in blood pressure among blacks when compared to white patients when they receive an equivalent dose of diuretics. In the Antihypertensive and Lipid-Lowering Treatment to Prevent Heart Attack Trial (ALLHAT) study (mean follow up of 4.9-years)[39] a greater systolic blood pressure reduction was observed in the group assigned to chlorthalidone when compared to angiotensin converting enzyme (ACE) inhibitor treated patients and the difference was even larger (4 mm Hg) when black patients were considered (35% of enrolled subjects). The greater blood pressure reduction was associated with a beneficial effect on stroke. Therefore, diuretics are considered the first line treatment in most black hypertensives. A comparison of the antihypertensive response between black and white patients suggests that blacks require between 3 and 4 times the dose of ACE inhibitor to achieve a response similar to that observed in non-black patients.[40] People of African origin were thus considered to be poorly responsive to AC inhibitors, largely as a consequence of low renin hypertension. However, these findings have been recently contested by others, most notably in the AASK study where ACE inhibitor showed greater beneficial effects than calcium channel blockers on renal outcomes (end stage renal disease or death) in African Americans.[41] The use of ACE inhibitors has been recently advocated in patients with renal disease irrespective of ethnic origin[42] even if the potential life threatening complication of ACE-inhibitor-induced angioedema has an adjusted relative risk of 4.5 in blacks.

Future strategies for risk reduction. Recent data obtained in European countries revealed that the rates of detection, treatment, and control are higher among black population indicating a greater awareness among the general public and physicians of the importance of detecting and managing hypertension particularly in black populations.[43] Conversely, it appears that the rates of detection, treatment and control of high blood pressure remain low among people of south Asian origin so that this group can now be considered at risk when compared

to the white population.[5] The environmental factors, negatively affecting the health of black immigrants should be combated not only by implementing systems to improve welfare facilities, and in particular blood pressure control, but also by routinely recommending a reduction in sodium intake. However, due to the relevant role of the environment and increasing urbanization, the greater attention to prevention strategies should be placed not only in Europe but specially in developing countries. Primary prevention of hypertension is possible through weight reduction, regular exercise, salt restriction and other dietary measures. It is important to identify groups where a particular intervention is more effective, such as salt restriction in the elderly, weight reduction in the young and middle aged, potassium supplementation in blacks. It is necessary to know what the optimal lifestyle intervention is and to define the best approaches and their impact on incidence of hypertension and its control. Finally, methods have to be developed to improve detection and control of hypertension. It is important to stress the value of cooperation between developing and developed countries in future hypertension research as in joint research projects developed countries can share in funding and expertise while developing countries can contribute data and scientific information that will improve the understanding of the role of ethnicity in hypertension.

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