

SOME MEDICAL IMPRESSIONS OF INDIA, WITH PARTICULAR REFERENCE TO DIABETES MELLITUS AND CARDIOVASCULAR DISEASE

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Since 1958, the Human Biochemistry Research Unit of the South African Institute for Medical Research, which is headed by Dr. A. R. P. Walker, and with which I am associated, has been studying the prevalence and certain aspects of the aetiology of coronary heart disease, cerebral vascular disease and diabetes mellitus in different population groups in South Africa. Investigations have been undertaken on Indian groups in Johannesburg, Pretoria, Pietersburg, Louis Trichardt and Durban. Studies have included the securing of dietary and other environmental knowledge, clinical and electrocardiographic examinations, and biochemical studies on blood, urine and stools. Among the more interesting findings to emerge from these investigations has been the high incidence of all three conditions in the South African Indian population. In these people it would appear that cerebral vascular accidents and diabetes are more common, and coronary heart disease only a little less common, than in South African Whites.¹ This situation clearly deserves close study, and it was decided that a valuable preliminary approach would be an investigation of the prevalence of these diseases in India, the country of origin of most South African Indians. The environment and mode of life of Indians in South Africa differ considerably from those of their fellows in India, and it was hoped that a comparison of prevalence rates might yield some clues as to aetiology.

I spent four weeks in India during December 1962 and January 1963, and the centres visited included New Delhi and Agra in the north, Madras and Vellore in the south, and Bombay in the west. The majority of South African Indians hail from the Madras and Bombay regions; most of the remainder come from North East India. In all, I was able to see something of the work done in 10 medical schools and 2 research institutes—the Haffkine Institute in Bombay, and the All-India Institute for Medical Sciences

in New Delhi. My numerous hosts included such internationally known figures as the cardiologists Padmavati, Vakil and Mathur, the pathologist Ramalingaswami, and the nutritionist, Radhakrishnan Rao. I must stress that, despite the strained relations which exist between India and South Africa, I was extremely well received wherever I went. The kindness and consideration shown to me were overwhelming, and my hosts took great pains to make my visit as informative and pleasant as possible.

In regard to the quality and quantity of the information I was able to obtain, some preliminary remarks concerning standards of medical care, teaching and research are necessary. These standards were high in a few centres, but mediocre or poor in the majority. There are several obvious reasons for the latter situation. First, and most important, is that most difficult and basic of all Indian problems, the enormous and rapidly growing population. Some 450,000,000 Indians live in an area similar in size to that of Africa south of the Zambesi. A good idea of the population explosion, and one of its main causes, can be gained from the following figures: In the 30-year period 1890 to 1920 when the natural checks of famine and pestilence were operating, the Indian population increased by only 12,000,000; in the 30-year period, 1920 to 1950, owing largely to the implementation of relatively simple and cheap public health measures, the population increased by 110,000,000. This tremendous increase in population constitutes a severe drain on the limited economy of the country, with the result that relatively little money is available for medical research or hospital services. Hospitals are grossly overcrowded and understaffed. Particularly prejudicial to good standards is the fact that most of the senior medical staff, including the professors, are employed on a part-time basis, and it was my impression that they spent far too much of their time in their private practices.

It was no coincidence that the best work was being undertaken at institutions where full-time employment was the rule. The population, with which the hospitals have to deal, is extremely poor (the average *per capita* income is less than R50 a year) and largely illiterate, so that follow-up of patients is generally inadequate. The major religions of India, Hindu and Moslem, forbid postmortems. Very few patients dying in hospital, therefore, come to necropsy, and if they do the procedure is usually a limited one, performed through a small incision in the epigastrium, and excludes examination of the cranial contents. Most post-mortem material is drawn from medico-legal cases and is of limited value from the research or teaching standpoints.

The validity, therefore, of much of the information given to me has to be viewed with reserve. Too often views were expressed which were based on impression rather than fact. What follows, therefore, consists of a relatively small core of fact and a much larger mass of impression, but I have tried to select only those impressions which appeared to be most firmly based and which could be corroborated from at least one other independent source. Finally, I would emphasize that my remarks are based on a relatively brief glimpse of a small part of a vast country whose constituent communities differ markedly in culture, religion, language, diet, socio-economic status, anthropometry and physical environment.

DIABETES

In most of the centres visited the prevalence of diabetes in the adult population was given as about 0.8 to 1.0%. However, none of the population surveys carried out has been free from bias, and it is probable that this figure will have to be revised in the future, but whether up or down is impossible to say. Furthermore, this prevalence only applies to urban communities, and I was unable to obtain any data on the rural population. In fact, there appeared to be very little medical information of any type on the rural communities. The reason is that while 83% of the vast population of India is rural, 80% of orthodox medical practitioners practise in the cities. For medical services, the rural dweller is largely at the mercy of traditional medicine men, quacks and unqualified dispensers. There were also no data on diabetic prevalence in Hindus as opposed to Moslems, or vegetarians and non-vegetarians. All workers were agreed, however, that the disease was commonest, and on the increase, in the wealthier sections of the community.

While the true prevalence of diabetes in India has yet to be established, all workers were almost certain that it was substantially less than that found in South African Indian adults. Both our own surveys in the Transvaal, and those of Wood² and Campbell³ in Natal, indicate a prevalence of at least 4%. There appear to be at least 2 reasons for the higher prevalence in South African Indians. Firstly, their standard of living, and hence, among other things, their life expectancy and incidence of obesity, are considerably greater than those of their fellows in India. Secondly, consanguinity is much commoner among South African Indians. The latter, like other immigrant Indian communities, adhere to the marriage patterns, not only of their

religion, but also of their village or town of origin in India. This means that about 60% of the South African Indian population permit or encourage marriage within the family. Some 40% of total South African Indians are Tamil or Telugu-speaking Hindus who originally came from villages or towns in South India, and, in accordance with the custom of this region, commonly practise cross-cousin marriage. Less frequent are marriages between the children of two sisters, while marriage between the children of brothers is forbidden. Until recently a man had a prescriptive right to marry his sister's daughter but this right is seldom enforced at present. It is also probably true that the incidence of close kin marriage among the younger generation is decreasing.⁴ Twenty per cent of South African Indians are Moslems, among whom first cousin marriages, both cross and parallel, are the preferred form of union. In India, marriage within the family is practised mainly by Southern Hindu who constitute about 20% of the population, and Moslems who make up another 10%, giving a total of 30%.

Lending credence to these suggestions, is the situation of the Parsee community in India, whose mode of life and pattern of disease are similar to those of South African Indians. It was generally agreed that diabetes, also myocardial infarction and cerebral vascular accidents, were very common in these people. Numbering some 100,000, these followers of the prophet Zoroaster constitute an extremely exclusive community, among whom consanguinity is common. Most of them live in Bombay where a large proportion are occupied in commerce, industry and the professions, and, as a community, their standard of living is far higher than that of the Indian population in general. An accurate survey of the prevalence of diabetes and vascular disease should not be too difficult to undertake in this community, and would give results of the greatest interest.

The diabetic syndrome in India appears to differ in a number of respects from that seen in South African Indians. The majority of South African Indian diabetics are female and obese; they rarely become severely ketotic and the majority are insulin independent, but vascular complications of all types are common and severe.⁵ In India, despite the fact that the majority of diabetics are over the age of 40, males are said to outnumber females in a ratio of about 3:2. Considering the very high frequency of grand multiparity among Indian women, this observation, if true, must support the views of those like Jackson,⁶ of Cape Town, who believe that pregnancy is not diabetogenic in normal women. The observation, however, which is at variance not only with the situation in South African Indians, but also with that in the South African Bantu and White populations generally, should be viewed with reserve. In the first place, it is based on analyses of diabetics attending hospital, and such cases almost certainly are biased in favour of males. Several workers stressed that because the Indian female is much less advanced socio-economically than the male, she is less likely to attend hospital. In fact she is less likely to seek treatment from any source, and if she does, she prefers to be treated by a private practitioner. Some observers did suggest that in private practice the sex incidence in diabetics, particu-

larly those over the age of 40, was equal. Secondly, more diabetic males than females are likely to be discovered and referred for treatment, since commercial, industrial, governmental and other organizations, which require routine medical examinations, employ many more males than females.

Less than half, and in some centres less than a quarter, of Indian diabetics are overweight when first diagnosed. However, in Madras it was stressed that about 70% of cases give a history of obesity preceding the development of symptoms, which is then followed by weight loss.

Ketosis, while not as frequent as in White or Bantu diabetics, appears to be commoner than in South African Indian cases, and in Delhi it was estimated that 9% of hospitalized diabetics were ketotic. The reason why some diabetics in India develop ketosis and others do not is obscure and is being actively investigated by Ahuja in Delhi. Absence of ketosis, for example, is not necessarily correlated with such features as obesity, maturity onset, or insulin resistance. Thus one encounters young, thin, insulin-sensitive diabetics, who nevertheless do not develop ketosis, very much like Shaper's K-type of African diabetic in Uganda.⁷ On the other hand, ketosis is not rare in middle-aged patients, and in one New Delhi series about two-thirds of ketotic cases were over the age of 40.

Most workers felt that some 50 to 60% of diabetics required insulin for adequate control, which is far higher than Campbell's figure of 4% for Natal Indian subjects.⁵

All the vascular complications of diabetes are seen in India, but they appear to be less common than in South African Indians. Several workers stressed that such complications were much commoner and more severe in the affluent diabetic.

A cause of diabetes, which is rare in the South African Indian but which is not uncommon in the southern part of India, is pancreatic calcification. This condition, of which the aetiology is obscure, mainly affects young people.

Campbell and McKechnie⁸ have drawn attention to the frequency with which hirsuties and hyperuricaemia are found in the Natal Indian diabetic, but neither association was recognized by any of the diabetologists in India. Campbell has also advanced the hypothesis that mustard oil, which is consumed by Indians in both India and South Africa, may give rise to diabetes by immobilizing free thiol groups, and on this basis has suggested that the administration of thiol-rich compounds may have an anti-diabetic effect.⁹ Ahuja, in Delhi, has tested this suggestion by treating some of his diabetics with the dithiol compound BAL, but failed to observe any significant response. It is, however, of interest that diabetes appears to be unusually prevalent in Bengal, the Indian state where mustard oil is apparently most widely consumed. Both Campbell⁵ and Cosnett¹⁰ have suggested that a herb or some other foodstuff peculiar to the Indian diet may be diabetogenic. In India I questioned many people about this possibility, also as to whether any of the substances used by practitioners of traditional medicine might be diabetogenic. All answered in the negative. Indeed, the converse appeared to be the case, it being claimed that a number of indigenous medicines are effective in the treatment of diabetes.

Finally, it is of considerable historical interest that more than 2,000 years ago, and long before Aretaeus wrote his classical description of diabetes, two Indian texts of medicine, Charaka Samhita and Sushruta Ayurveda, not only gave an equally detailed and graphic account of the symptoms of the condition, but also recognized both genetic and environmental factors in its aetiology, commented on the serious effects of infection on the disease, and recommended dietary therapy which was remarkably modern in its outlook.

CORONARY HEART DISEASE

Most postmortem studies of the coronary arteries in India have revealed that fatty streaking is as common as in White populations, but that the more advanced atherosclerotic lesions such as fibrous or calcified plaques, are far less frequent. The findings, in fact, are rather similar to those in the South African Bantu. These studies, however, have been largely based on medico-legal material and almost certainly do not reflect the true position. Pathologists in Bombay, where a relatively large number of necropsies are performed on patients dying in hospital, have found that advanced atherosclerotic lesions are by no means uncommon, and this is in keeping with the results of clinical and epidemiological investigations. These have shown that while coronary heart disease is not as common as in White communities or, for that matter, in South African Indians, it is certainly not rare. Different centres in India report a widely varying prevalence, with coronary heart disease constituting from 26% to 6% of cardiac patients treated in hospitals. As a percentage of cardiac deaths in hospital, the range is even wider—43% to 4%. Many factors are responsible for these widely varying figures, not the least being the marked socio-economic, dietetic and other differences in the populations on which they are based. Nevertheless, even the lowest figures indicate that the condition is not rare, and are much higher than those for South African Bantu.

All observers were agreed that coronary heart disease is commonest in the upper classes—army officers, wealthy merchants and professional people—in whom it would appear to constitute a problem as serious as in most White populations. These Indians enjoy a diet high in animal protein and fat and are largely sedentary; and obesity, diabetes and hypertension are all common among them. It was also agreed that the condition is on the increase in both males and females and that affected subjects are not infrequently under the age of 40.

Most interesting, perhaps, was the almost universal opinion that coronary heart disease was not rare among the poorer classes, and that it was also increasing among them. There appears to be little doubt that, even allowing for differences in the size of the population at risk, the condition is commoner among the *poor* urbanized Indian than the *average* urbanized Bantu. This is an intriguing situation which must cast doubt on some of our concepts of the aetiology of coronary artery disease, considering that these poor Indians have a standard of living considerably below that of our urban Bantu, that their diet is lower in total calories and most nutrients, including fat, and that, like the Bantu, the great majority are manual labourers. Their daily fat intake, in fact, is very low. In

one study in Bombay it averaged 23 G while in another in South India it varied between 7 and 12 G. In both regions, furthermore, the major part of the fat taken was in the form of vegetable oils, the fatty acids of which are largely unsaturated. Some observers even made the point that coronary heart disease was increasing in poor communities at the same time that their diets were actually getting worse. No convincing explanation could be offered for this paradox, although most workers seemed inclined to favour stress, which they believed had increased markedly with urbanization and industrialization, and the consequences of overcrowding, intense competition for relatively few jobs, poverty and sickness.

In most centres serum-cholesterol levels showed the expected variation with socio-economic status. In the upper classes the figure varied between 180 and 240 mg. per 100 ml. and in the low-income group it was between 130 and 160 mg. per 100 ml. In a study in Bombay most of a series of cases of myocardial infarction occurring in poor Indians had relatively low serum-cholesterol values, but in other centres it was noted that a fair proportion of such cases had high levels. These could not be explained on a dietary basis, and it was considered that some other, as yet unknown, factor is responsible.

It is worth emphasizing that India offers virtually unique opportunities for the study of the effects of dietary fats of different degrees of saturation on atherogenesis, thrombogenesis and cholesterologogenesis. Thus, in Madras most of the fat consumed is in the form of oils obtained from ground nuts and sesame seeds, and is mainly unsaturated. In Kerala, also South India, the population almost exclusively uses coconut oil which is largely saturated. Workers in India are aware of this challenge but much remains to be done.

CEREBRAL VASCULAR DISEASE

Although there are no adequate statistics on the frequency of cerebrovascular accidents in India, it would appear that, at comparable ages, the condition is considerably less common than among South African Indians in whom the prevalence is among the highest in the world. A possible reason for this is that, as Padmavati has shown, the incidence of hypertension is very low among the poorer classes in India, who constitute the bulk of the population. Furthermore, according to both Vakil and Mathur, when significant hypertension does occur, it is much more likely to result in cardiac failure than a cerebrovascular accident. In fact, cerebral haemorrhage, the hallmark of hypertensive cerebrovascular disease, is distinctly uncommon in India, the majority of cerebrovascular accidents being due to thrombosis.

A point of considerable interest for students of Bantu medicine concerns the relative frequencies of cerebral and coronary thrombosis. The latter, as is well known, is very rare in the Bantu; but the former is common, and this paradox still defies explanation. In India the majority of workers were agreed that, in contrast with the Bantu, myocardial infarction is commoner—some said three to four times commoner—than cerebral thrombosis. This view was supported by postmortem studies in both Agra and Bombay showing that atherosclerosis is generally more severe

in the coronary than in the cerebral vessels. Others, however, disagreed and stated that cerebral thrombosis is commoner. Still others, and perhaps this is nearest the truth, stated that the relative frequency of the two conditions varied with age. In the aged cerebral thrombosis was as common as, if not commoner than, myocardial infarction, but in the middle and younger age groups, which constitute the bulk of the population, myocardial episodes are definitely more frequent.

MISCELLANEOUS

Other features of cardiological and general medical interest, particularly from the South African standpoint, include the following: Cardiomyopathy of unknown cause is a major problem in the South African Bantu. It has been suggested that the condition is due to malnutrition, and Gillanders, who originally described it in Johannesburg, actually termed it 'nutritional heart disease'. If this hypothesis is correct, one would expect the condition to be very common in India where malnutrition is rife. Yet the majority of workers stated that they had not encountered the condition, and doubted very much whether it occurred in India. However, idiopathic cardiomyopathy may simulate a number of diseases, such as mitral incompetence, hypertensive heart failure and pericardial effusion, and unless observers are aware of the condition it may be missed. This is especially likely in India, where very few patients dying in hospital come to postmortem. I was therefore more impressed with the views of the minority of observers, who included Vakil and Mathur, both cardiologists of immense experience, who stated that while most cases of heart failure could be explained on the basis of known causes, there remained a proportion, about 5-8%, in which the aetiology was obscure and which resembled the idiopathic cardiomyopathies of Africa. Shah in Bombay has actually reported a small series of cases¹¹ of which one came to necropsy and was very similar to the massive endomyocardial fibrosis commonly seen in East Africa. Another presented with the features of constrictive pericarditis, and the diagnosis of cardiomyopathy was established at thoracotomy. A third case presented with heart failure in the puerperium, a variant of cardiomyopathy which is not uncommon in Bantu both in Johannesburg and Durban.

The principal cardiological problem in India is rheumatic heart disease. A feature of the condition is the remarkable frequency with which established valve lesions are seen in young children, and it was estimated that, on the average, Indian subjects with chronic rheumatic valve disease became symptomatic about a decade earlier than White sufferers. It is also noteworthy that in contrast to the frequency of chronic valve lesions, acute or subacute manifestations such as chorea, nodules and rashes are all rare, and even polyarthritis is not too common.

Cor pulmonale is common in North India, where, for a non-industrial region, its incidence is said to be the highest in the world. The condition, which is often seen in young adults, presents with severe congestive heart failure, and is rapidly progressive with death ensuing after 6 months to 3 years. A suggested cause is the chronic inhalation of noxious substances derived from the burning of dung—a commonly used fuel during the cold winters in

North India—in overcrowded and poorly ventilated dwellings.

The major nutritional syndrome in India, in both adults and children, is protein malnutrition. Most of the other nutritional diseases are seen, but it is noteworthy that pellagra and scurvy, which are common in Bantu adults, are rare in India. Beri-beri is also rare despite the fact that India is largely a rice-eating country. The reasons given for this freedom are that the sale of highly polished or milled rice is forbidden or discouraged, also the custom in recent years of parboiling the cereal.

Both siderosis and porphyria cutanea tarda are very common in the Bantu. The former is virtually unknown in India, while the latter, if it occurs at all, must be very rare. Hepatic cirrhosis, both postnecrotic and portal, is extremely common in India, but the aetiology, as in the Bantu, is still largely obscure. Gynaecomastia, another common condition in the Bantu, is apparently rare in India. Finally, India is the country of a number of interesting environmentally determined cancers. Oral carcinomas constitute about 40% of all Indian cancers and are generally attributed to the habit of betel chewing. The quid which is chewed consists of a complex mixture of materials, of which betel leaf is only one, and it is probable that the carcinogenicity is not related to the leaf itself but to one or more of the other substances, particularly tobacco. In some parts of India, chuttas or cigars are smoked with the lighted end inside the mouth, and this is associated with cancer of the palate. Cancer of the skin of the lower abdomen and inner thigh occurs in Kashmir, where the people carry wicker baskets

containing a pot of burning coals or pine needles under their clothes during the cold winters.

CONCLUSION

The information gained during this visit, limited though it was, has clarified a number of issues concerning diabetes and cardiovascular disease in the Indian populations of South Africa and India. More important, perhaps, it has revealed how much still has to be done before really meaningful comparisons and conclusions can be drawn. Workers in India are acutely aware of the challenge, they are keen to collaborate with us, and the establishment of contacts with them should do much to hasten progress.

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