CLINICAL NOTES

Vascular Disease in South African Bantu Diabetics

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Summary. The prevalence of vascular disease was studied in 2 groups of maturity-onset South African Bantu diabetics: a) 50 new cases and b) 62 old patients whose mean duration of disease was 7 years. All the subjects were city-dwellers of long standing, in whom obesity, hypertension and hypercholesterolaemia were common. Diabetic retinopathy was present in 11% of the new and 45% of the old patients; the corresponding figures for proteinuria were 8% and 29%. By contrast, not a single subject in either group was found to have evidence of myocardial infarction, and only 8% of the new and 6% of the old diabetics had myocardial ischaemia.

La maladie vasculaire chez les diabétiques Bantous Sud-Africains.

Résumé. La répartition de la maladie vasculaire a été étudiée chez 2 groupes de sujets Bantous d'Afrique du Sud, devenus diabétiques à l'âge moyen: a) chez 50 cas récents et b) chez 62 patients dont la durée moyenne de la maladie était de 7 ans. Tous ces sujets résidaient dans les villes depuis longtemps; chez eux l'obésité, l'hypertension et l'hypercholestérolémie étaient fréquentes. La rétinopathie diabétique était présente chez 11% des diabétiques récents et chez 45% des patients diabétiques de-

puis longtemps; les données correspondantes en ce qui concerne la protéinurie étaient respectivement de 8% et 29%. Par contraste, pas un seul sujet dans chacun des groupes n'a montré de manifestations d'infarctus myocardique, et seulement 8% des diabétiques récents et 6% des malades atteints de diabète depuis longtemps avaient de l'ischémie myocardique.

Gefäßerkrankungen bei Diabetikern unter den Bantus Südafrikas.

Zusammenfassung. Wir untersuchten das Auftreten von Gefäßerkrankungen bei 2 Gruppen von Altersdiabetikern vom Bantustamm in Südafrika und zwar: a) bei 50 neu entdeckten Fällen und b) bei 62 Diabetikern, deren Erkrankung im Mittel seit 7 Jahren bekannt war. Alle Untersuchten wohnten seit langer Zeit in der Großstadt und wiesen in erheblichem Maße Übergewicht, Hochdruck und Hypercholesterinämie auf. In 11% der neuen und 45% der alten Fälle bestand eine diabetische Retinopathie; die entsprechenden Werte für die Proteinurie lagen bei 8 und 29%. Im Gegensatz dazu fanden sich bei keinem einzigen der Probanden aus beiden Gruppen Anhaltspunkte für einen Herzinfarkt und nur 8% der neu entdeckten und 6% der schon länger bekannten Diabetiker wiesen eine Mangeldurchblutung des Myokards auf.

Previously, in Johannesburg Bantu it was observed that the diabetic syndrome on the whole was similar to that seen in White populations [13]. The main difference concerned the rarity of all forms of vascular disease, myocardial infarction especially, in Bantu diabetics. That study, however, was partly retrospective, and undertaken a decade ago when most of the diabetics examined were new. Furthermore, in recent years there has been a marked rise in the standard of living and degree of westernization of the Bantu population associated with the very rapid rate of commercial and industrial development in Johannesburg. It was therefore decided to re-examine the question of vascular disease in both old and new Bantu diabetics.

Subjects and methods

One hundred and twelve Bantu diabetics attending Baragwanath Hospital Diabetic Clinic were studied during 1964. All were urbanized and most had been resident in Johannesburg for more than 20 years. All were over 40 years, and fell into 2 groups according to the duration of diabetes from the time of diagnosis:

1. 50 new patients (32 females, 18 males) whose disease had been present for less than 1 year.
2. 62 old diabetics (36 females, 26 males) whose disease was of at least 3 years duration, the mean being 7 years. In about half the duration was 3 to 5 years, and in the other half between 5 and 10 years. Mean duration was similar in males and females.

¶ All females in both groups were postmenopausal; premenopausal women are known to be relatively immune to atherosclerotic disease and for this reason were excluded.

At the time of the study, modes of therapy and degree of diabetic control in the 2 groups were similar. About 60% were on oral hypoglycaemic agents, mainly tolbutamide and chlorpropamide, 30% were on insulin, and 10% on diet alone. Before 1960, most of the old diabetics were treated with insulin; later, oral therapy was substituted in the majority. Control was either poor or moderate, particularly in insulin-treated subjects. In general, only symptomatic relief was obtained, the achievement of biochemical control being impracticable in a population whose socio-economic status is low and whose diet consists largely of carbo-

hydrate in the form of maize, bread, sorghum and potato.

All subjects were investigated as follows:

1. A single observer (H.C.S.) undertook a detailed clinical examination of the cardiovascular system, including careful study of the eye-grounds in a dark room after atropinization. The unequivocal presence of microaneurysms was a minimum criterion for the diagnosis of diabetic retinopathy.

2. Heights and weights were measured. Subjects were regarded as overweight if they exceeded by 10% or more the mean weights for age, height and sex of Metropolitan Life Insurance Company Tables. Two categories of overweight were recognized: a) 10–24% and b) 25% or more overweight.

3. A 12-lead electrocardiogram was recorded at rest, and if the tracing was normal, it was repeated after exercise. Myocardial infarction was diagnosed according to criteria laid down by the World Health Organisation Committee on "Hypertension and Coronary Heart Disease" [5]. Myocardial ischaemia was diagnosed if the ST segment was depressed by 1 mm or more.

4. Serum cholesterol was estimated by the method of PEARSON et al. [9], and uric acid by the method of EICHHORN et al. [4] in 49 new and 59 old diabetics.

the higher proportion of moderately overweight males in the old as compared with the new group. In both groups, females differed from males in 2 important respects. Firstly, the majority were severely overweight. Secondly, they were mostly unskilled (domestic servants or housewives), whereas the majority of males were skilled (mainly artisans, but also a few clerks and teachers).

Table 2 lists the principal cardiovascular findings in the 2 groups of diabetics. Two features stand out — substantial prevalence of retinopathy and the rarity of coronary heart disease. Eleven per cent of new and 45% of old diabetics, whose eye-grounds were not obscured by cataract, were found to have retinopathy. Closer analysis of the old group showed that the prevalence of retinopathy among 25 patients with diabetes of 3 to 5 years duration was 28%, whereas among 25 subjects with disease of 6 to 10 years duration it was 56%. In both old and new groups retinopathy appeared to be commoner among females than males. In all the new, and in three quarters of the old, diabetics with retinopathy, the lesions consisted largely of microaneurysms and round haemorrhages in small or moderate numbers. In the remaining quarter of old cases microaneurysms and haemorrhages were more

Table 1. *Characteristics of 50 new and 62 old Bantu diabetics*

	New Diabetics		Old Diabetics	
	18 males	32 females	26 males	36 females
Age: Range	41–71	44–69	44–79	45–80
(Years) Mean	53	54	58	56
Skilled	15 (83%)	3 (10%)	19 (73%)	2 (6%)
Unskilled	3 (17%)	29 (90%)	7 (27%)	34 (94%)
10–24% overweight	3 (17%)	4 (13%)	13 (50%)	6 (17%)
25% or more overweight	7 (39%)	24 (75%)	8 (30%)	28 (78%)
Years postmenopausal:				
Range		1–22		0.5–30
Mean		8.6		9.0

Table 2. *Cardiovascular abnormalities in 50 new and 62 old Bantu diabetics*

	New Diabetics						Old Diabetics					
	18 Males No.	%	32 Females No.	%	50 Total No.	%	26 Males No.	%	36 Females No.	%	62 Total No.	%
Retinopathy	0/17	0	5/27	19	5/44 ¹	11	7/22	32	18/33	55	25/55 ¹	45
Cardiac infarction	0	0	0	0	0	0	0	0	0	0	0	0
Cardiac ischaemia	1	5	3	9	4	8	1	4	3	8	4	6
Diastolic pressure more than 95 mm Hg.	5	28	17	53	22	44	13	50	21	58	34	55
Proteinuria	1	5	3	9	4	8	9	35	9	25	18	29

¹ Because of cataract, 6 new and 7 old diabetics could not be examined for retinopathy.

Results

Table 1 shows that the groups of new and old diabetics were similar in regard to sex composition, mean age, occupational status, prevalence of obesity, and, in the case of females, the mean number of years after menopause. The only noteworthy difference was

numerous, and were associated with neovascularization. Hard yellowish-white exudates were commonly seen in both old and new subjects with retinopathy.

Hypertension, defined as a diastolic pressure greater than 95 mm Hg., was common in both groups. In most cases it was mild or moderate, the diastolic

pressure being less than 120 mm Hg. In 2 new and 3 old subjects, however, the pressure varied around 130 mm Hg. In these patients great care was taken to differentiate hypertensive from diabetic retinopathy; both new subjects were adjudged to have hypertensive retinopathy only, but all 3 old cases were assessed as showing both hypertensive and diabetic retinal changes.

In regard to coronary heart disease, not a single subject in either group had clinical or electrocardiographic evidence of myocardial infarction, and none complained of effort angina. In only 4 new and 4 old diabetics was myocardial ischaemia present, as evidenced by ST segment depression of 1 mm. or more. Three of the 4 old subjects were also hypertensive, and this, rather than coronary heart disease, may have caused the depressed ST segments. In about 10% of old and new diabetics the dorsalis pedis or posterior tibial pulse could not be felt at the ankle, but in no case was there other evidence of ischaemia of the feet. Failure to palpate these pulses was probably due to their being obscured by fat or oedema.

mean cholesterol levels for males with and without retinopathy were 225 and 231 mg%, respectively, and the corresponding figures for females were 254 and 246 mg%.

Discussion

Vascular disease in diabetics is broadly of 2 types, the specific small vessel disease or microangiopathy, manifested principally by retinopathy and nephropathy, and the non-specific large vessel disease or occlusive atherosclerosis. Our earlier impression [13] that both forms were rare in Bantu diabetics is thus demonstrably incorrect. The present study, while confirming the rarity of atherosclerosis, has revealed that microangiopathy, retinal certainly and renal probably, is common in the Bantu. A similar dissociation of the prevalence of small and large vessel disease has been reported among diabetics in other developing populations. TULLOCH [14] observed retinopathy in 22% of 250 Jamaican diabetics, but in 125 subjects in whom electrocardiograms were recorded, no cases of myocardial infarction were found. TULLOCH also commen-

Table 3. Serum cholesterol and uric acid levels in 49 new and 59 old Bantu diabetics

Serum Cholesterol mg%	New Diabetics				Old Diabetics			
	Male	Female	Total		Male	Female	Total	
	No.	No.	No.	%	No.	No.	No.	%
117-149	2	3	5	10.2	2	1	3	5.1
150-199	5	14	19	38.8	9	8	17	28.7
200-249	8	11	19	38.8	3	10	13	22.0
250-299	1	3	4	8.2	7	8	15	25.4
300-349	1	0	1	2.0	2	4	6	10.3
350-399	0	1	1	2.0	0	3	3	5.1
400+	0	0	0	0	1	1	2	3.4
Totals	17	32	49	100	24	35	59	100
Serum Cholesterol mg%	206.6	203.0	204.1		220.6	247.7	236.6	
Mean and S.D.	±42.5	±47.2	±45.0		±67.8	±71.4	±70.8	
Serum Uric Acid mg%	5.3	5.1	5.2		5.6	4.5	5.0	
Mean and S.D.	±1.2	±1.6	±1.4		±1.5	±1.2	±1.4	

Proteinuria was much more common in the old diabetics. In about half the affected cases, it appeared to be caused by diabetic glomerulosclerosis, but in the other half, hypertensive nephrosclerosis or pyelonephritis may also have been responsible. Detailed renal studies were not undertaken.

The biochemical findings are shown in Table 3. Serum uric acid levels were similar in both groups. Serum cholesterol values were higher among the old diabetics, especially the old females. Six (12%) of the new and 26 (44%) of the old subjects had serum cholesterol levels between 250 and 400 mg%; 1 of the new and 8 of the old patients also had proteinuria, and it is possible that diabetic nephropathy was in some measure responsible for their raised cholesterol levels. There was no correlation between the cholesterol values and retinopathy; analysing the old group, the

ted on the rarity of effort angina in Jamaican diabetics. The prevalence of retinopathy in 100 Japanese diabetics was 13%, but atherosclerotic complications were virtually absent [10]. Of 76 diabetic Yemenite Jews, 9 (13%) had retinopathy, but there was only 1 case of myocardial infarction and none with evidence of myocardial ischaemia [3]. In all these studies — Jamaican, Japanese and Yemenite — the duration of diabetes in the majority of subjects examined for retinopathy was less than 5 years.

These findings in developing countries have several important implications. Firstly, the substantial prevalence of small vessel disease among diabetics in such widely differing environments is further testimony, if this were needed, that microangiopathy is specifically related to the diabetic syndrome. It is also clear that the factors responsible for the genesis of the specific

microangiopathy must be different from those causing the non-specific atherosclerosis. Secondly, diabetic control in unsophisticated populations consuming high carbohydrate diets is much inferior to that in Western countries. Yet there is no evidence that this predisposes towards a significantly higher incidence of microangiopathy. The Bantu prevalence of retinopathy is very similar to that reported by KORNERUP [7] in his careful study of 1000 unselected Swedish diabetics. For retinopathy in subjects of similar age and duration of diabetes to our old Bantu diabetics, his figures were 42% for males, 46% for females, and 44% for total males and females. The rise in frequency of retinopathy with increasing duration of diabetes was also similar in the Bantu and Swedish groups of subjects. In Japanese, Jamaican and Israeli Yemenite subjects retinopathy, if anything, is less common than in European diabetics. Thirdly, the diets of Bantu and other non-White diabetics are low in fat, especially animal fat, and it is clear that such diets offer little or no protection against the development of microangiopathy. This is in keeping with the finding that low fat diets are not effective in the treatment of retinopathy [2]. Fourthly, and also in agreement, the prevalence of retinopathy in Bantu subjects did not correlate with serum cholesterol levels. The absence of relationship has also been noted in American diabetics [1]. Fifthly, in both old and new Bantu diabetics retinopathy appears to be commoner in females than males. This cannot be explained by differences in age or duration of diabetes, which were similar in the two sexes. It may be related to the higher prevalence of obesity in the females, but whatever the reason it is evident that sophistication and westernization cannot be incriminated, since most of the Bantu females were uneducated and unskilled.

Hypertension was common in both old and new diabetics, but it is not known whether it is significantly commoner than in non-diabetic Bantu of similar age, sex and habitus, in whom hypertension is also frequently found.

The rarity of coronary heart disease in Bantu diabetics is of considerable interest. It is generally agreed that coronary atherosclerosis is very common in White diabetics, and that its incidence and severity are greater than in non-diabetics. In addition, the relative immunity of females to ischaemic heart disease is virtually abolished by diabetes. Thus, in U.S.A. LIEBOW *et al.* [8] found coronary heart disease in 42% of 383 diabetics, the female prevalence being only slightly less than that of the male. In England, KEEN *et al.* [6] observed electrocardiographic evidence of myocardial infarction in 6%, and myocardial ischaemia in 26%, of 104 diabetics, whose age and sex composition were similar to our Bantu cases. The rarity of coronary heart disease among the Bantu subjects is all the more remarkable when it is remembered that they possessed a number of characteristics, all of which are currently thought to be promotive of occlusive atherosclerosis. Firstly, they were not only diabetic, but, as already

mentioned, their diabetes was not well controlled, and in half the cases was of relatively long duration. Secondly, in a substantial proportion of subjects the diabetes was associated with hypercholesterolaemia. Thirdly, obesity, especially among the females, was very common and often severe. Fourthly, hypertension was also common. Fifthly, all the Bantu subjects were city-dwellers of long standing, and in the case of the males, the majority were in the process of becoming westernized. Considering that most had grown to young adulthood in a primitive tribal environment, and then had to adapt to the complex existence of a modern, rapidly developing city, it is probable that their stresses were at least equal to, if not greater than, those of most Whites. Finally, they were all in the age group when atherosclerotic disease is commonest, and all the females were postmenopausal.

The precise reasons for this situation are unknown, but it is now well established that occlusive atherosclerosis of the coronary arteries is extremely rare in the general Bantu population, and it is probable that the factors responsible for this immunity are also operative in Bantu diabetics. In previous studies [11, 12] we have suggested that these factors include a diet low in animal fat and a high level of physical activity. To what extent these two factors were protective in the Bantu diabetics is uncertain. They were not specifically evaluated in this study, but some of the subjects, the skilled workers especially, had led a relatively sedentary existence. We also had evidence that in at least half the subjects the diets, although consisting largely of carbohydrate, also contained appreciable amounts of animal fat, perhaps amounting to 20% of total calories, in the form of meat, or less commonly, dairy products. It is therefore likely that other factors are at work. The possibilities are numerous, considering the wide social, economic, cultural, psychological, genetic and other differences between Bantu and Whites, but they still await investigation.

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