Chronic diabetic complications in Africa

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Well-conducted epidemiological data regarding chronic diabetic complications in Africa are limited. Most reports have small samples derived from tertiary referral clinics, underlining the need for larger scale community-based studies. However, there is little doubt that the prevalence of complications has increased in keeping with the rising occurrence of diabetes. This is likely to strain the health budgets of often resource-poor countries. For example, a recent estimate in Tanzania showed that treatment of diabetic complications represented 31% of total outpatient costs in the main hospital in Dar es Salaam, with a yearly cost of $138 per person; 19 times more than the average.[1]

Retinopathy

Mbanya and Sobngwi[2] looked at data for the prevalence of diabetic complications in Africa and reported that retinopathy was present in 16–55% of people with diabetes. About a quarter of newly diagnosed type 2 patients present with retinopathy, and severe retinopathy represented 15% of all cases.[2] Perhaps not surprisingly, duration of diabetes and glycaemic control were found to be major determinants of retinopathy.[2] In another review of diabetic complications in Africa, Sidebe[3] reported that more than half of the patients with type 2 diabetes had retinopathy, and retinopathy accounted for 32% of all eye complications. He suggested that differences observed in patients with varying ethnic origins may be linked primarily to unfavourable social and economic conditions that worsen the risk of poor blood glucose control.[3]

In a study involving 300 randomly selected black African patients from primary care in Cape Town, South Africa, the prevalence of any grade of retinopathy was 55% – proliferative and pre-proliferative retinopathy 16%, and cataracts 8%.[4] In most cases the complications were not documented in the clinic records of the preceding year. The high prevalence of suboptimal glycaemic and blood pressure control, as well as complications of diabetes largely unrecorded in the preceding year's clinic notes, demonstrates the deficiency of and the need for preventative diabetes care at primary care level.[4] Another study,[5] comparing microvascular complications in black and Indian South Africans, showed a high prevalence of retinopathy at 53% (blacks 56%, Indians 45%). Onset of retinopathy from the time of diabetes diagnosis occurred about 5 years earlier in blacks compared with Indians. The prevalence of hypertension was much higher in blacks than Indians (42% vs 9%, $p<0.5$), though this marked difference may in part be due to the small size of the study.[5]

Rotimi et al[6] looked at the prevalence and risk factors for diabetic retinopathy and cataracts in 840 patients with type 2 diabetes and 191 spouse controls, enrolled from 7 centres in Ghana and Nigeria. In this cohort (whose mean age was 46 years), the prevalence of diabetic retinopathy was 18%. Cataracts were present in 45% of patients with type 2 diabetes, and in 18% of spouse controls. The risk of developing retinopathy increased more than 3-fold for patients with the highest fasting plasma glucose (FPG) level (odds ratio (OR)=3.4), compared with patients at the lowest FPG level.[6] The OR for persons with diabetes of 10 years or more, compared with persons with diabetes for less than 5 years, was 7.3 for retinopathy, and 2.6 for cataract.[6] They concluded that cataracts were a more important cause of visual impairment than diabetic retinopathy in this cohort. In addition, the prevalence of cataract in patients with diabetes was more than twice that of their spouse controls, indicating that type 2 diabetes was an important risk factor for cataract formation. Individuals who developed type 2 diabetes at an earlier age were more likely to develop both diabetic retinopathy and cataracts. A strong positive association was observed between FPG level, duration of diabetes, and risk of retinopathy and cataract, underlining the need for early eye examination at first presentation of elevated blood glucose.[6]

The diabetic foot, diabetic neuropathy and peripheral vascular disease

Abbas and Archibald[7] looked at published data regarding the diabetic foot in Africa, encompassing the years 1960–2003. Perhaps not surprisingly, foot ulceration and infection were associated with considerable long-term disability and premature mortality.[7] Rates of complications varied by country, e.g. foot ulcers 4–19%, peripheral neuropathy 4 to 84%, peripheral vascular disease 3–79%, gangrenous foot ulcers 0.6–69%, and foot amputation rates 0.3–45%. They cited a study of diabetic patients in Tanzania that showed mortality rates of over 50% among patients with severe foot ulcers who did not undergo surgery.[8]

Epidemiological studies from Europe and North

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America have shown diabetic peripheral neuropathy to be one of the most common complications of diabetes, occurring in 28–55% of diabetic patients[9–11], and appears to be influenced by age, duration of diabetes, glycaemic control; and traditional markers of macrovascular disease such as smoking, hypertension, obesity, and hyperlipidaemia.[12] Though there are few studies that are well designed and examine the prevalence or incidence of peripheral neuropathy in Africa, there is little doubt that neuropathy is the strongest risk factor for foot ulceration and amputation worldwide, including in the African setting.[13,14] It is indeed the most frequent cause of prolonged hospital admission in diabetic patients,[14] and is a significant contributor to the considerable morbidity associated with the diabetic foot.

There is some variation in the epidemiology of the diabetic foot problems in Africa, largely reflecting differing criteria for data collection, and this is particularly problematic for peripheral neuropathy. Table 1 shows the range of occurrence of peripheral neuropathy, mainly as a result of differing criteria for the definition of neuropathy, methods of assessment and selection bias.[7] However, it is clear that regardless of this, neuropathy is very common.

Table 1 Prevalence of diabetic neuropathy in Africa[7]

Year	Country	Patient number	Neuropathy rate
2003	Zambia	185	61%
2000	Tanzania	200	26%
1997	South Africa	300	28%
1996	Uganda	252	46%
1995	Ethiopia	43	50%
1995	Sudan	128	37%
1991	Malawi	100	59%
1990	Nigeria	50	68%

Peripheral vascular disease (PVD)

Foot complications in Africa are mainly as a result of infection in the neuropathic foot rather than due to PVD.[7,15–17] However, the rapid urbanisation of communities across Africa is having an increasing impact on the prevalence of macrovascular disease, including PVD. A study from Nigeria reported evidence of PVD in 54% of diabetic patients with foot complications,[18] whilst another more recent study from Tanzania found PVD in 21% of diabetic patients.[8] Table 2 shows rates of PVD in different parts of Africa.[7] As with neuropathy, there is a great variability, in the rates reported, partly due to assessment differences. Although neuropathy is often the initiating factor for foot ulceration, ischaemia is critically important in determining healing. Abbas and colleagues have reported the prevalence of neuroischaemic lesions in diabetes patients in Tanzania at about 17%.[18] Unfortunately, despite a relatively low prevalence rate of PVD in diabetic patients with foot ulcers in Africa, amputation is a frequent outcome mainly due to uncontrolled infection.[7]

Table 2 Prevalence of peripheral vascular disease (PVD) amongst diabetic patients in Africa[7]

Year	Country	Patient number	PVD rate
2003	Zambia	185	41%
2002	Tanzania	92	21%
1997	South Africa	300	8%
1995	Ethiopia	43	12%
1995	Sudan	128	10%
1991	Malawi	100	15%
1990	Nigeria	50	54%

Foot ulceration

In Africa, as in the rest of the world, peripheral neuropathy is the main risk factor in the pathogenesis of foot ulceration in diabetic patients.[15] A Nigerian study[19] reported that 15% of diabetic hospital admissions were due to foot ulcers, with 80% of these being first time occurrences. Unfortunately, despite the low prevalence rate of PVD, amputation was an outcome in a third of patients and was associated with progressive infection. and/or missed neuroischaemic lesions. The highest inpatient mortality rate (50%) was observed in patients with severe foot ulcers whose management did not include surgery with amputation.[19] Overwhelming sepsis related to the severe foot infections may explain these high rates of mortality. This study also reported that there were major issues with regard to obtaining consent for minor or major amputations of often severely affected limbs,[19] mainly due to cultural factors where a loss of limb was considered to be worse than a loss of life.[13,18] Several factors have been identified as greatly increasing the risk of ulceration and amputation,[18,20] as well as the traditional risk factors of neuropathy and PVD:

(a) poverty and barefoot walking;
(b) inappropriate footwear;
(c) poor foot hygiene;
(d) delay in seeking medical attention.

In addition, there have been reports of rat bites on the toes of people who sleep on the floor or outdoors.[21]

Perhaps the most important intervention for the prevention of diabetic foot complications is education of the patient about appropriate foot care. With the establishment of foot clinics, major amputations have been generally reduced in western countries. Patients with foot lesions are seen either in a multidisciplinary Foot Clinic or a Podiatry Led Clinic (for neuropathic ulcers), and treated early with antibiotics, removal of callus, and given appropriate advice regarding footcare etc. In most African countries the situation is different, and these low-cost clinics run by podiatrists (and possibly nurses with some training) are not available. Such clinics, adapted to the African situation, could result in a reduction of foot-related hospital admission and the prevention of major amputations. Abbas and Archibald suggest two important patient rules – regular foot inspection and making an effort not to walk barefoot – for the prevention of foot problems in Africa.[7] They go on to suggest that the prevention of peripheral neuropathy through

aggressive glycaemic control may be the single most important primary preventative measure for lower limb ulceration or infection.[7] Early diagnosis of peripheral neuropathy and PVD and diabetic foot education may also go a long way in reducing the prevalence of foot ulceration and amputation.[7]

Diabetic nephropathy

Diabetic nephropathy is the leading cause of end-stage renal disease in the Western world.[22–24] Published data on nephropathy in the African diabetic population are scarce.[22] However, there appears to be a racial difference in the prevalence of diabetic nephropathy and end-stage renal failure. For example, African-American patients have been reported to have a greater risk of diabetic nephropathy and kidney damage than their Caucasian counterparts.[25] Over the past three decades, the prevalence of microalbuminuria in African diabetic patients has varied greatly[26–29] (see Table 3). A recent study also suggests that diabetic nephropathy may be assuming an increasing role as a cause of chronic kidney disease in Africa.[30]

Table 3 Prevalence of microalbuminuria in diabetes patients in Africa[7]

Year	Country	Patient number	Microalbuminuria rate
2006	Tanzania	91 type 1 153 type 2	12% (type 1) 10% (type 2)
2002	Kenya	100 type 2	26% (type 2)
1999	Cameroon	64 mixed	53%
1997	Ethiopia	71 type 1 99 type 2	32% (type 1) 37% (type 2)
1992	Nigeria	113 type 2	57% (type 2)

In a recent study by Lutale and colleagues of microalbuminuria among type 1 and type 2 diabetic patients of African origin in Dar es Salaam, the overall prevalence of microalbuminuria was 11% and macroalbuminuria 5%.[22] In type 1 patients, microalbuminuria was present in 12% and macroalbuminuria in 1%. Among type 2 patients, 10% had microalbuminuria and 7% had macroalbuminuria. Type 2 patients with abnormal albumin excretion rates had a significantly longer duration diabetes (7.5 years, range 0.2–24 years) than those with a normal albumin excretion rate (3 years, range 0–25 years, $p<0.001$). Systolic and diastolic blood pressure among type 2 patients with microalbuminuria were significantly higher than those without ($p<0.001$).[22] The most significant differences seen in body mass index, glycaemic control, and cholesterol levels were found among patients with normal compared with those with elevated albumin excretion rates, either in type 1 or type 2 diabetes. However a stepwise multiple linear regression analysis among type 2 patients revealed duration of diabetes, systolic blood pressure, and serum creatinine to be independent risk factors. The authors concluded that the prevalence of micro- and macroalbuminuria was higher among type 1 patients with a relatively short diabetes duration, compared with the prevalence among Caucasians. In type 2 diabetes, the prevalence was in accordance with findings in Caucasians.

Diabetic nephropathy is emerging as a major cause of end-stage renal disease (ESRD) in sub-Saharan Africa.[30] The prevalence of diabetic nephropathy as a cause of ESRD has also been looked at in north Africa. Afifi and colleagues in Egypt[31] performed a 6-year multiple cross-sectional study between 1996 and 2001, for the prevalence of diabetic nephropathy. Prevalence gradually increased from 8.9% in 1996 to 14.5% in 2001. The mean age of patients with diabetic nephropathy was significantly higher than that of patients with ESRD from other causes. Mortality was also significantly higher in diabetic patients with ESRD.[31] Gill and colleagues[32] looked at the long-term (20 years) mortality, with causes of death, in a cohort of type 1 diabetic patients resident in Soweto, South Africa. They found, leaving aside those lost to follow-up, that most mortality was as a result of renal failure related to diabetic nephropathy. They concluded that this reflected the lack of adequate facilities for renal replacement therapy in Africa. Another study from South Africa has also shown that renal failure in type 2 diabetic patients is a major cause of death.[33]

A study from Nigeria looked at the distribution of cardiovascular risk factors among subjects with type 2 diabetes and nephropathy, since in nephropathy the excess mortality is mainly cardiovascular.[34] They found that there was a high prevalence of cardiovascular risk factors among Nigerian subjects with clinical diabetic nephropathy.[34] Another study from Nigeria identified patients with diabetic nephropathy as a high-risk group for excess cardiovascular morbidity.[35]

Coronary artery disease

Kengne and colleagues have recently reviewed cardiovascular complications of diabetes in sub-Saharan Africa.[36] The lack of diagnostic facilities limits studies in coronary heart disease (CHD) in sub-Saharan Africa,[36] as coronary angiography and myocardial scintography are available only in a few urban health facilities. However, ischaemic heart disease was considered to be rare in Africa two decades ago,[36] yet is now regularly seen.[36]

Ischaemic heart disease may be present at the clinical onset of diabetes in up to 5% of patients.[37] A study from Ghana reported that 80% of subjects with cardiovascular disease presenting to a major cardiac referral centre had CHD.[38] Compared with subjects with other cardiovascular disorders, those with CHD were older and had a higher incidence of hypertension (66%). Nearly a quarter had diabetes.[38] In a study from Cameroon, CHD ranked eighth among cardiovascular diseases, with a prevalence of 1.5%.[39] Myocardial infarction (43%), predominantly anterior (73%), was the most frequent clinical form of CHD observed. Obesity (80%), hypertension (60%), hyperlipidaemia (43%), smoking (36%), and diabetes (26%)

were the major risk factors reported in the study. Three -quarters of the patients had at least three risk factors.

In East Africa, a Sudanese study reported that CHD (at 28%) was the most frequent macrovascular complication of diabetes, followed by PVD (10%) and stroke (5%).[40] In a dual-armed study, consisting of retrospective and prospective comparative arms, black Kenyans who underwent coronary angiography were studied. The risk factors found to be most strongly associated with the presence of angiographically detected CHD were diabetes, dyslipidaemia, age, and male gender. There was a high prevalence of hypertension, which was not predictive of CHD.[41] Cigarette smoking was uncommon in most surveys. In a study of 139 patients from Dar es Salaam, using clinical and resting electrocardiogram (ECG) parameters, findings compatible with ischaemic heart disease were found in 34% patients, and in 6% the ECG changes were classified as 'probable ischaemia'.[42]

Cerebrovascular disease

Epidemiological data on cerebrovascular disease in Africa have been scarce because of the low proportion of patients presenting to hospitals, the high mortality rate, and inaccuracies and deficiencies in death certification. In Tanzania, regular censuses of three surveillance populations consisting of 307 820 people (125 932 aged below 15 years and 181 888 aged 15 or more) were undertaken with prospective monitoring of all deaths arising in these populations between 1992 and 1995.[43] During the 3-year observation period 11 975 deaths were recorded in the three areas, of which 7629 (64%) were in adults (54% of these in men and 46% in women). In these adults, 5.5% of the deaths were attributed to cerebrovascular disease, 53% of these in men and 47% in women. The yearly age-adjusted rates per 100 000 in the 15–64 year age group for urban dwellers were 65 for men, and 88 for women, as compared with the England and Wales (1993) rates of 11 for men and 9 for women. These high rates in Tanzania were probably due to untreated hypertension. In this study 4.4% of type 2 diabetic patients presented with stroke at diagnosis of diabetes.[43]

At a hospital in Burkina Faso, cerebrovascular disease accounted for 15% of admissions for cardiovascular disorders, and of these 72% of patients had low incomes and 22% were labourers. The major risk factors were poorly controlled hypertension (84%), obesity (44%), hyperlipidaemia (21%), thromboembolism (17%), smoking (12%), hypercholesterolemia (8%) and diabetes (7%). The authors emphasised the need for improvement in the management of hypertension by district physicians.[44]

In an early study from Zambia of 600 diabetic patients, Rolfe reported a 1.2% stroke rate.[45] In a more recent prospective study of type 2 diabetic Nigerians, stroke-associated death occurred in 8%. All the stroke-related deaths occurred in the hypertensive group.[46] Male patients also appeared to have a significantly enhanced risk of stroke-related deaths.

Diabetes-related cardiovascular complications are becoming more prevalent in Africa. Currently, most available resources are being channelled to fighting communicable diseases such as HIV/AIDS and TB. However, the burden of diabetic complications will continue to rise unless systems are in place to tackle this tide.

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