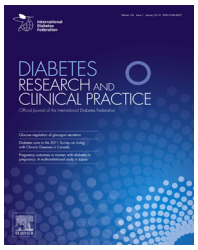
Contents available at ScienceDirect

Diabetes Research and Clinical Practice

journal homepage: www.elsevier.com/locate/diabres

International Diabetes Federation



Retinopathy in type 1 diabetes mellitus: Major differences between rural and urban dwellers in northwest Ethiopia

Shitaye Alemu [a], *Abere Dessie* [a], *Asamere Tsegaw* [b], *Christopher C. Patterson* [c], *Eldryd H.O. Parry* [d], *David I.W. Phillips* [e], *Elisabeth R. Trimble* [c,*]

[a] *Department of Internal Medicine, Gondar University Hospital, Gondar, Ethiopia*
[b] *Department of Ophthalmology, Gondar University Hospital, Gondar, Ethiopia*
[c] *Centre for Public Health, Queen's University Belfast, Belfast, UK*
[d] *London School of Hygiene and Tropical Medicine and Tropical Health Education Trust, London, UK*
[e] *MRC Lifecourse Epidemiology Unit, University of Southampton, Southampton, UK*

ARTICLE INFO

Article history:
Received 19 December 2014
Received in revised form
27 February 2015
Accepted 12 April 2015
Available online 20 April 2015

Keywords:
Retinopathy
Maculopathy
Cataract
Hypertension
Rural
Africa

ABSTRACT

Aim: To audit levels of diabetes-related eye disease in Type 1 diabetes mellitus (T1DM) patients in northwest Ethiopia. In particular to establish whether, despite identical clinical goals, major differences between the physically demanding life-style of rural subsistence farmers and the sedentary life-style of urban dwellers would influence the prevalence of diabetes-related eye complications.

Methods: A robust infrastructure for chronic disease management that comprehensively includes all rural dwellers was a pre-requisite for the investigation. A total of 544 T1DM were examined, representing 80% of all T1DM patients under regular review at both the urban and rural clinics and representative of patient age and gender (62.1% male, 37.9% female) of T1DM patients from this region; all were supervised by the same clinical team. Eye examinations were performed for visual acuity, cataract and retinal changes (retinal photography). HbA1c levels and the presence or absence of hypertension were recorded.

Results/conclusions: Urban and rural groups had similar prevalences of severe visual impairment/blindness (7.0% urban, 5.2% rural) and cataract (7.3% urban, 7.1% rural). By contrast, urban dwellers had a significantly higher prevalence of retinopathy compared to rural patients, 16.1% and 5.0%, respectively (OR 2.9, $p < 0.02$, after adjustment for duration, age, gender and hypertension). There was a 3-fold greater prevalence of hypertension in urban patients, whereas HbA1c levels were similar in the two groups. Since diabetic retinopathy is closely associated with microvascular disease and endothelial dysfunction, the possible influences of hypertension to increase and of sustained physical activity to reduce endothelial dysfunction are discussed.

* Corresponding author. Tel.: +44 0 28 9066 0125; fax: +44 0 28 9023 5900.
E-mail addresses: e.trimble@qub.ac.uk, etrimble@btinternet.com (E.R. Trimble).
http://dx.doi.org/10.1016/j.diabres.2015.04.010
0168-8227/

1. Introduction

Relatively little is known about the clinical outcomes of many chronic diseases in the developing countries. Reports from the developing world often include only cases from the urban and peri-urban areas; this is particularly the case for T1DM. T1DM, defined here as diabetes which has been treated continuously with insulin, without remission, from the first clinical presentation, causes visual impairment chiefly through the development of cataract and retinopathy. Although cataracts are seen frequently in patients with type 2 diabetes mellitus (T2DM), they also occur in T1DM; at a global level chronic hyperglycaemia and the duration of diabetes are major aetiological factors for cataract formation [1,2]. Diabetic retinopathy and associated maculopathy are due to microvascular disease in which there is endothelial dysfunction giving rise to leakage of fluid from the retinal capillaries into the perivascular space, retinal oedema, small haemorrhages, and collapse of the capillaries. The resultant retinal ischaemia is associated with the stimulation of growth factors such as VEGF and the development of new fragile blood vessels; this stage, proliferative retinopathy, poses great risks for major bleeds and retinal detachment resulting in significant visual impairment [3]. Hyperglycaemia is a major cause of diabetic retinopathy and stricter blood glucose control is associated with improved outcomes as first shown clearly in the Diabetes Control and Complications trial (DCCT) [4]. Other factors include hypertension [5], and disturbances of lipid metabolism [6]. There is also emerging evidence that diabetic retinopathy is a polygenic disorder, with familial clustering, and different levels of heritability for proliferative and non-proliferative retinopathy [7] Of particular importance in the present context are lifestyle factors and the differences between urban and rural groups, especially the level of physical activity which has been shown to have glucose-independent effects on endothelial function in T1DM [8]. Visual impairment and blindness are handicaps in any society and especially so in regions where access to appropriate clinical services may be limited; in these areas severe visual impairment and blindness are closely associated with poverty.

In order to inform long-term, strategic planning for chronic disease management it is important to have an accurate assessment of the burden of disease in the rural population as well as in those who live in urban and peri-urban areas. In sub-Saharan Africa a large proportion of the population lives in distant rural areas; in Ethiopia, rural dwellers account for 80% of the population. The greatest barrier to accurate data collection from rural dwellers has been the widespread lack of infrastructures for chronic disease management in these people. We will present audit data on eye disease in T1DM as an example of clinical outcomes in a chronic disease from a region in northwest Ethiopia. The region is served by a central referral hospital and a system of multiple, supervised rural health clinics up to 90 km distant. This sustainable, structured approach to chronic disease management has been developed over the past two decades with urban and rural clinics being supervised by the same clinical team.

The chief aim of the audit was to establish whether significant lifestyle differences between urban and rural dwellers were associated with different levels of eye disease, despite identical clinical goals for the two groups.

2. Patients and methods

2.1. Context

This is the report of an audit carried out to assess the status of diabetes-related eye disease in Gondar and the surrounding area of northwest Ethiopia. Gondar is one of the centres where there has been a remarkable development of infrastructure to manage chronic diseases in a way that effectively includes the rural population. In this region of the Ethiopian northwest the overall direction, ethos, goals and management of both the urban and rural clinical diabetes services, including patient education, have been overseen by the same clinical consultant physician (SA) for more than 20 years. Although the clinical goals have been identical for the two communities there are several differences in living conditions. Rural dwellers, mainly subsistence farmers, have a life-style that is physically demanding in the extreme, have a lower BMI than their urban counterparts [9], and keep close to the traditional diet of unrefined flours, mainly teff and corn, legumes, a limited selection of vegetables and fruits and minimal amounts of animal protein. There are some specific difficulties for rural T1DM patients; thus, it is exceptionally rare for them to have a fridge for insulin storage, money to buy glucose test strips or a watch/clock to tell the time of day. Urban dwellers in this region have a more sedentary life-style compared to the rural population but have kept relatively close to a traditional diet; although some change is occurring, there has been little move to a western-type diet as has happened in other areas of the developing world. Both urban and rural groups are affected by the limited laboratory resources available to monitor their progress; because of these limitations HbA1c, micro-albuminuria and lipids are not measured as a routine. Alterations in disease management are based on the recent clinical history, the presence or absence of hypertension ($\geq$140/90 mmHg) [10] and on fasting blood glucose levels measured at the clinic visit.

2.2. Patient inclusion

A general invitation was given to all patients (urban and rural) to come to the central clinic for assessment of their sight, including retinal photography with a static camera. This report is on 544 T1DM patients who were screened and who represent approximately 80% of all rural T1DM and 80% of all urban T1DM cases followed up on a regular basis at the rural and urban clinics, respectively. They are also representative of their parent groups with respect to age and sex ratio; there is a well-documented preponderance of males, especially in the rural group [9,11].

2.3. Eye examination

2.3.1. Visual acuity

Tumbling-E Snellen's charts (recommended for those not used to the Roman alphabet) were used to assess visual acuity, starting the examination with the patient at 6 m distance from