THE MAGNITUDE AND PATTERN OF DIABETIC

RETINOPATHY IN JIMMA UNIVERSITY HOSPITAL,

JIMMA, ETHIOPIA

A study carried out in part fulfillment for the degree of Master of Medicine in Ophthalmology in

the University of Nairobi

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2009

Declaration

This dissertation is my original work and has not been presented for a degree in any other university.

Signed ……………………………………………… Date …… 18/6/09

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Approval

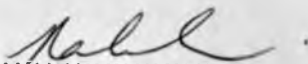This dissertation has been submitted for examination with our approval as University Supervisors

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Dedication

Dedicated to Mequanint Melesse for his tremendous contribution since the inception of my career.

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List of Abbreviations

BCVA   Best corrected Visual acuity

BP   Blood Pressure

CSME   Clinically Significant Macular Edema

CURES   Chennai Urban Rural Epidemiological Study

DCCT   Diabetes Control and Complication Trial

DR   Diabetic Retinopathy

DRS   Diabetic Retinopathy Study

ETDRS   Early Treatment of Diabetic Retinopathy Study

FBS   Fasting Blood Sugar

HBA1c   Glycosylated haemoglobin

HRPDR   High Risk Proliferative Diabetic Retinopathy

IDDM   Insulin Dependent Diabetes mellitus

IFG   Impaired Fasting Glucose

IGT   Impaired Glucose Tolerance

JUH   Jimma University Hospital

NHRPDR   Non High Risk Proliferative Diabetic Retinopathy

NVD   Neovascularization at the disc

NVE   Neovascularization Elsewhere

OHA   Oral Hypoglycaemic Agents

PDR   Proliferative Diabetic Retinopathy

UKPDS   United Kingdom Prospective Diabetic Study

WESDR   Wisconsin Epidemiologic Study of Diabetic Retinopathy

Abstract

Aim: To determine the prevalence and pattern of diabetic retinopathy in Jimma University hospital, Jimma, Ethiopia.

Design: A cross sectional hospital based study was carried out in Jimma University hospital. The study was conducted from February to March 2009.

A total of 324 patients ranging from 13-80 years of age were identified using systematic sampling with a response rate of 89.3%. They underwent detailed eye examination for diabetic retinopathy. The blood pressure of all patients was measured, and fasting blood sugar was also determined for those without recent fasting blood sugar. Clinical grading of diabetic retinopathy was done by using the ETDRS guidelines.

Results: The prevalence of diabetic retinopathy was found to be 41.4%. Severe NPDR was found in 7(2.2%) patients and CSME was found in 16(4.9%) patients and vision threatening diabetic retinopathy was found in 7.3% of patients. A statistically significant association was found between diabetic retinopathy and duration, FBS, and mean systemic blood pressure. Only 47(14.5%) subjects had an eye examination prior to this study. Among the study subjects only 43.2% had their fasting blood sugar below 7mmol/l.

Conclusion: The prevalence of diabetic retinopathy was high in this study, and very few subjects had eye examinations prior to this study. Majority of the subjects had poor blood sugar control which probably explains the high prevalence of diabetic retinopathy. There is a need for a regular screening program in the eye unit and need of vitro-retinal facility especially laser services.

1 Introduction and Literature Review

Diabetes mellitus

The term diabetes mellitus describes a metabolic disorder of multiple etiologies characterized by chronic hyperglycemia with disturbances of carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, insulin action, or both. Diabetes mellitus can lead to serious complications and premature death but people with diabetes can take steps to control the disease and lower the risks of complications.[2]

1.1 Epidemiology of diabetes mellitus

Diabetes mellitus is among the leading causes of death, disability and economic loss through out the world.[6, 7] Its prevalence varies widely in different populations and is continuing to rise. Worldwide the prevalence of diabetes mellitus is estimated at 6%.[2] The World Health Organization had estimated that there were 171 million people worldwide with diabetes mellitus in 2000 and has predicted that 366 million people will have diabetes mellitus by 2030.[11] The increase will mainly be due to increases in middle and low income countries.

The International Diabetes Federation has estimated that another 314 million persons have impaired glucose tolerance and that the number will increase to 472 million by 2030.[7] In the United States of America, for example, as much as 7% of the population had diabetes mellitus in 2005, and the prevalence and incidence are increasing. The Centers for Disease Control and Prevention have estimated that 14.6 million persons in the United States have diagnosed diabetes mellitus and an additional 6.2 million have the disease but it has not yet been diagnosed.[5]

Diabetes is increasing faster in the developing economies than in the developed economies. WHO predicts that developing countries will bear the brunt of this epidemic in the 21st century with 80% of all new cases of diabetes expected to appear in the developing countries by 2025. Seven out of ten countries with the highest number of people living with diabetes are in the developing world and India has the world's largest population with diabetes, approximately 35 million people.[2]

It was estimated that 26 million people in China had Diabetes mellitus in 2001 and the prevalence has increased markedly recently due to population aging and increases in urban migration.[25] The 2007 estimate for China has grown up to 39.8million.[54]

Persons with diabetes mellitus in developed countries are mostly elderly, most of those in developing countries are younger (45-64 years) thus increasing the impact of diabetes mellitus on those populations and societies[11]. Rather than being a disease of affluence, diabetes is actually a disease more associated with poverty. Even in developed countries, the highest prevalence of diabetes is in the lowest socio-economic groups.[54]

According to the World Health Organization, an estimated seven million Africans suffer from this disease which is now ranked as the fourth main cause of death in most developing countries. The International Federation of Diabetics (FID) projects that the prevalence rate will shoot up by 95 percent by 2010 from the current 0.5 to 3 percent range across the continent. The Ethiopian setup is not an exception, according to WHO estimate there were 796000 in the year 2000and the figure is projected to be 1,820,000 in 2030.[54]

1.2 Clinical features of diabetes mellitus

Diabetes mellitus may present with characteristic symptoms such as thirst, polyuria, polyphagia, blurring of vision, and weight loss. In its most severe forms, ketoacidosis or a non-ketotic hyperosmolar state may develop and lead to stupor, coma and, in absence of effective treatment, death. Often symptoms are not severe, or may be absent, and consequently hyperglycaemia sufficient to cause pathological and functional changes may be present for a long time before the diagnosis is made. People with diabetes are at increased risk of cardiovascular, peripheral vascular and cerebrovascular disease.[56]

The long-term effects of diabetes mellitus include progressive development of the specific complications of retinopathy with potential blindness, nephropathy that may lead to renal failure, and/or neuropathy with risk of foot ulcers, amputation, Charcot joints, and features of autonomic dysfunction, including sexual dysfunction.

1.2.1 Pathogenesis

Several pathogenetic processes are involved in the development of diabetes. These include processes which destroy the beta cells of the pancreas with consequent insulin deficiency, and others that result in resistance to insulin action. The abnormalities of carbohydrate, fat and protein metabolism are due to deficient action of insulin on target tissues resulting from insensitivity or lack of insulin.

1.2.2 Classification of diabetes mellitus

Several classifications exist for diabetes. The recommended classification includes both staging of diabetes mellitus based on clinical descriptive criteria and a complementary etiological

classification. The etiological type named Type 1 or insulin dependant diabetes mellitus (IDDM) encompasses less than 10% of diabetics, of which majority are primarily due to pancreatic islet beta–cell destruction and are prone to ketoacidosis. It includes those cases attributable to an autoimmune process, as well as those with beta–cell destruction and those for whom neither aetiology nor pathogenesis is known (idiopathic).

Type 2 includes the common form of diabetes (over 90%) which results from defect(s) in insulin secretion, almost always with a major contribution from insulin resistance. The class "Impaired Glucose Tolerance" is classified as a stage of impaired glucose regulation, since it can be observed in any hyperglycemic disorder, and is itself not diabetes. A clinical stage of "Impaired Fasting Glycaemia" has been introduced to classify individuals who have fasting glucose values above the normal range, but below those diagnostic of diabetes.

1.3 Diagnostic criteria.

There is abundance of data indicating that hyperglycaemia is harmful. However there are limitations in the data and the methodologies used to derive cut off points at which this level of harm is specifically increased and which clearly differentiates diabetes from non diabetes. It is thus difficult to accurately define normal glucose levels. Despite the limitations with the data from which the diagnostic criteria for diabetes are derived, the current WHO criteria distinguish a group with significantly increased premature mortality and increased risk of microvascular and cardiovascular complications.

The current (2006) WHO diagnostic criteria for diabetes are as follows:

<u>Diabetes</u>

Fasting Plasma glucose   ≥7.0mmol/l (126mg/dl)

Or 2-hour plasma glucose*   ≥11.1mmol/l (200mg/dl)

<u>Impaired glucose tolerance (IGT)</u>

Fasting Plasma glucose   <7.0mmol/l (126mg/dl)

And 2 hour plasma glucose*   ≥7.8mmol/l and <11.1mmol/l

                                                (140mg/dl and 200mg/dl).

<u>Impaired fasting glucose (IFG)</u>

Fasting plasma glucose   6.1-6.9mmol/l (110 mg/dl- 125mg/dl)

2 hour plasma glucose*   <7.8mmol/l (140mg/dl)

* Venous plasma glucose 2 hours after ingestion of 75g oral glucose load (or 1.75g/kg in children). If 2-hour plasma glucose is not measured, status is uncertain as diabetes or IGT cannot be excluded.

The diagnosis of diabetes in an asymptomatic subject should never be made on the basis of a single abnormal blood glucose value. For the asymptomatic person at least one additional plasma/ blood glucose test result with a value in the diabetic range is essential (either fasting or from oral glucose tolerance test).

Treatment

The management of Diabetes includes dietary control, weight reduction, exercise, oral hypoglycaemic agents and insulin, without undermining the paramount importance of patient

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education as well. But details about treatment of diabetes mellitus are beyond the scope/objective of this research.

1.4 Diabetic Retinopathy

Diabetic retinopathy is a progressive dysfunction of retinal vasculature caused by chronic hyperglycemia.[1] It is a common complication of diabetes and leading cause of visual loss in diabetic patients and the most frequent cause of visual loss among working age persons in developed countries.[4] Diabetic Retinopathy is responsible for approximately 5% of global blindness and accounts for approximately 2.5 million people blind.[4]

1.4.1 Pathogenesis of diabetic retinopathy

Diabetic retinopathy is a microangiopathy affecting the retinal precapillary arterioles, capillaries and venules with features of both microvascular occlusion and leakage.[38, 40] Several factors have been implicated in the mechanism(s) for diabetic retinopathy. These include aldose reductase induction, myo-inositol depletion, non enzymatic glycation and free radical damage. The major tissues affected by diabetes are retina, kidneys and nerves- which are all freely permeable to glucose.[36] Growth factors may also influence the progression of diabetic complications by altering the innate glucose regulatory mechanism.

Due to factors that are not yet fully understood, there is reduction in the number of pericytes which are usually wrapped around capillary endothelial cells and are thought to be responsible for the structural integrity of the vessel wall. The reduction in pericytes leads to localized

weaknesses in the vessel wall causing saccular pouches of capillary wall distention clinically seen as microaneurysms. It also leads to breakdown of the inner blood-retinal barrier causing plasma constituents to leak into the retina.

Increased vascular permeability and microaneurysms lead to haemorrhage and retinal edema, which may either be diffuse or localized. Chronic localized retinal edema leads to the deposition of hard exudates at the junction of healthy and edematous retina. The hard exudates are composed of lipoproteins and lipid filled macrophages, typically surrounding leaking microvascular lesions, forming a circinate pattern. They may sometimes get absorbed spontaneously into the surrounding healthy capillaries or may get enlarged due to chronic extravasation.

Microvascular occlusion is thought to be due to several factors including; thickening of the capillary basement membrane, capillary endothelial cell damage and proliferation, changes in the red cells leading to defective oxygen transport and increased stickiness and aggregation of platelets. Capillary non perfusion leads to retinal hypoxia which in turn causes retinal ischemia. Initially, the non perfused area is located in the mid retinal periphery. Retinal hypoxia leads to formation of arteriovenous shunts associated with significant capillary occlusion ("dropout") which run from venules to arterioles referred to as intra-retinal micro-vascular abnormalities (IRMA) and neovascularisation, thought to be formed by a vasoformative substance, elaborated by the hypoxic retinal tissue in an attempt to revascularise hypoxic areas of the retina. This substance promotes neovascularisation.

1.4.2 Classification of diabetic retinopathy

Different classifications for diabetic retinopathy exist depending on the purpose. However diabetic retinopathy can be classified into early stage, Non Proliferative Diabetic Retinopathy (NPDR) and a more advanced stage Proliferative Diabetic Retinopathy (PDR). NPDR is further classified into mild, moderate, severe and very severe NPDR. PDR may be early, high risk or advanced. Macular edema can be present at any level of diabetic retinopathy. The retinal microvascular changes that occur in NPDR are limited to the confines of the retina and do not occur beyond the internal limiting membrane (ILM).

Characteristic findings in NPDR include: microaneurysms, dot and blot hemorrhages, retinal edema, hard exudates, dilatation and beading of retinal veins, intraretinal microvascular abnormalities (IRMA), nerve fiber layer infarcts, arteriolar abnormalities and areas of capillary non perfusion.

NPDR can affect vision through two mechanisms:

1) Intraretinal capillary closure resulting in macula ischemia.

2) Increased retinal capillary permeability resulting in macula edema.

Macula edema is the more common cause of visual loss in diabetic patients. It may manifest as focal or diffuse retinal thickening with or without exudates.

Severe NPDR is defined by the ETDRS by the 4:2:1 rule.

- Diffuse intra retinal hemorrhages and microaneurysms in 4 quadrants.

- Venous beading in 2 quadrants.

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- Intraretinal microvascular abnormalities (IRMA) in 1 quadrant.

Proliferative Diabetic Retinopathy (PDR) is characterized by neovascularisation on the optic nerve head (NVD=new vessels at the disc) or along the course of the major vessels (NVE=new vessels elsewhere). Extraretinal fibrovascular proliferation extends beyond the internal limiting membrane and may lead to vitreous or pre-retinal haemorrhage or may contract to cause tractional retinal detachment.

The Diabetic Retinopathy Study (DRS) and Early Treatment Diabetic Retinopathy Study (ETDRS) classified DR into 9 stages:

1. Normal or minimal non proliferative diabetic retinopathy (No DR) i.e. with rare microaneurysms.

2. Non proliferative diabetic retinopathy without macula edema.

3 Non proliferative diabetic retinopathy with macular edema that is not clinically significant.

4. Non proliferative diabetic retinopathy with clinically significant macular edema (CSME)

CSME is defined by the ETDRS as the following:

- Thickening of the retina at or within 500 microns of the center of the fovea.   Or

- Hard exudates at or within 500 microns of the center of the fovea, if associated with thickening of the adjacent retina.

Or

- A zone or zones of retinal thickening one disc area or larger, any point of which is within a disc diameter of the center of the macula.

5. Severe non proliferative retinopathy (pre-proliferative).

6. Non high risk proliferative diabetic retinopathy without clinically significant macula edema. (NHRPDR without CSME)

7. Non high risk proliferative diabetic retinopathy with clinically significant macula edema (NHRPDR with CSME).

8. High risk proliferative diabetic retinopathy (HRPDR). The high risk characteristics for severe visual loss are neovascularisation at the disc (NVD) greater than 1/4 to 1/3 disc area or vitreous and/or preretinal haemorrhage accompanied by new vessels, either NVD or NVE which is ≥ 1/4 disc area.

9. High risk proliferative diabetic retinopathy not amenable to photocoagulation.

1.4.3 Epidemiology of diabetic retinopathy

Diabetic retinopathy is a leading cause of new onset blindness in industrialised countries and a more and more frequent cause of blindness in middle income countries. WHO has estimated that diabetic retinopathy is responsible for 4.8% of the 37 million cases of blindness through out the world.[4] It develops nearly in all persons with type 1 diabetes and in more than 77% of those with type 2 who survive over 20 years with the disease[22]. In the Wisconsin epidemiologic study of diabetic retinopathy, 13% of the study population who had had diabetes for less than 5 years and 90% of those who had had it for 10-15 years, had some degree of diabetic retinopathy.[16]

Of those with an onset of 30 years or more (presumed type 2), 20% who were taking insulin and 24% who were not, had some degree of diabetic retinopathy when the duration of diabetes mellitus was less than 5 years[13]. When the duration of diabetes mellitus was 15-20 years, 84% taking insulin and 53% not taking insulin had some degree of diabetic retinopathy.[18] Sixty percent of people who have had insulin dependent diabetes mellitus for 20 years or more will have proliferative diabetic retinopathy.[22] While more than 12% of those who have had the condition for 30 years or more, will be blind.[26]

Each year in the United States, over 33,000 new cases of diabetic macula oedema, 86,000 cases of proliferative diabetic retinopathy and 12,000-14,000 new cases of blindness occur.[26, 21]

Several studies on the prevalence of diabetic retinopathy have been done. Population based studies tend to show lower prevalences compared to hospital based studies. In Australia, the Australian diabetes, obesity and lifestyle study reported a prevalence of 15.3%,[20] while in India, the Chennai urban rural epidemiological study (2005) reported prevalence of 17.6%[15]. In Liverpool, another population based study, the Liverpool diabetic eye study, found prevalence of 33.6%[22].

Mainly hospital based studies have been done in Africa. Dr. Kariuki et al found prevalence of 49.8% at Kenyatta National Hospital in Nairobi, Kenya.[14] Nabatanzi C found prevalence of 35.2% in Uganda. Kaimbo DK found prevalence of 32% in Democratic Republic of Congo[17] while Seyoum B in Ethiopia(Addis Ababa), found prevalence of 37.8%[12] and Mhando PA in Dar es-Salaam reported prevalence of 25%[27]. In rural Kenya, Dr. Kibata found a prevalence of 18%.[51]

1.4.4 Risk factors:

These following risk factors have been shown to have associations with diabetic retinopathy:

Duration of the disease: Duration is probably the strongest predictor for development and progression of retinopathy. The Wisconsin epidemiologic study of diabetic retinopathy, a wide ophthalmologic survey, reported that higher prevalence of DR was associated with longer duration of diabetes.[26] In a study conducted by Dandona et al in type 2 diabetic patients, it is reported that 87.5% of those with diabetes for more than 15 years had diabetic retinopathy compared to 18.9% of those who had diabetes for less than 15 years. [13]

Glycaemic control: There is strong evidence to suggest that the development and progression of diabetic retinopathy is influenced by the level of hyperglycaemia.[19, 27] The protective effect of glycaemic control on the development and progression of DR has been investigated in both type 1 by the Wisconsin Epidemiological Study of diabetes retinopathy (WESDR) and diabetes control and complications trial (DCCT) and type 2 diabetic patients by United Kingdom prospective diabetes study (UKPDS). [28, 30, 31] In the 14 year progression of retinopathy study (WESDR), the prevalence of retinopathy in type 1 diabetic patients was 12% when glycated haemoglobin (HBA1c) was less than 7% as compared to 40.7% when HBA1c levels were greater than 10% and an increased risk of PDR was associated with more severe baseline retinopathy and higher HBA1c levels[27]. In the UKPDS, the risk reduction in eye complications for every 1% decrease in HBA1c was 19% [31]. It is thus observed that long term glycaemic control plays an important role in delaying the onset and lowering down the progression of diabetic retinopathy.

Hypertension: Reports have indicated that high diastolic blood pressures in young individuals and higher systolic blood pressures in older individuals, can worsen DR.[36]

Renal disease: A link between renal and retinal angiopathy in diabetes, has been long recognised. This is an effect that may be mediated through an increase in blood pressure, fibrinogen levels and lipoproteins[32]. Cross sectional and longitudinal studies report a relationship between microalbuminuria, proteinuria and retinopathy.[32, 33, 34] Proteinuria was present in 29.2% of the subjects with DR in the CURES eye study.[15]

Pregnancy: It is recognised that DR can progress rapidly during pregnancy due to hormonal changes. The long term risk of progression of DR does not appear to be increased by pregnancy but there is usually transient progression.[45] A study done in Kenya showed no significant difference in the prevalence of diabetic retinopathy between the pregnant and non pregnant women.[55] Other risk factors that have been shown to be associated with Diabetic retinopathy include: elevated serum lipids,[36, 44] alcohol,[39] anaemia[40, 41] and obesity.[36]

1.4.5 Treatment of Diabetic Retinopathy.

Evidence based treatment reported from several studies indicate that treatment can reduce the risk for severe visual loss and blindness from PDR by more than 90%.[8] The Diabetic Retinopathy Study (1971-1978) demonstrated conclusively that scatter laser photocoagulation reduces the risk of severe visual loss due to PDR by as much as 60%.[50] The Diabetes Control and Complication Trial (1983-1993) conclusively demonstrated that intensive control of blood glucose as reflected in measurements of glycosylated hemoglobin reduced he risk for progression of diabetic retinopathy.[30, 48] The Diabetic Retinopathy Vitrectomy Study (1977-1987) provided insight into the timing of vitrectomy surgery to restore useful vision in eyes with non resolving vitreous haemorhage.[50] In particular, it highlighted that in certain situations, early vitrectomy resulted in better vision. The Early Treatment of Diabetic Retinopathy Study (1979-1990) demonstrated that laser photo coagulation can reduce the risk of severe visual loss to less than

2%. It also showed focal laser photocoagulation can reduce the risk for moderate visual loss from diabetic macular edema by 50%.[30]

1.5 Screening.

In its early stages diabetic retinopathy does not reduce vision. Preventing blindness from retinopathy relies on early detection of asymptomatic disease by fundus examination and instituting appropriate treatment measures immediately. Fundus examination can be done by direct ophthalmoscopy, using a slit lamp and either a contact lens or a 90 D lens or by retinal photography.[48] It has been shown that seven standard field stereoscopic 30° fundus photography is the gold standard for assessing diabetic retinopathy, however digital color photography can also be used. Recently, several new non invasive techniques promise to improve diagnostic sensitivity e.g. the optical coherence tomography (OCT).[46] In the western world, it has been reported that about 26% of patients with type 1 and 36% of patients with type 2 diabetes mellitus have never had their eyes examined.[46] In Kenyatta National Hospital, Nairobi Kenya, 82% of the 601 diabetic patients examined were being seen by an ophthalmologist for the first time and 48.6% of them required treatment for diabetic retinopathy.[14] The situation in most other African countries may not be any different given the limited number of eye care health professionals available. This underscored the need for screening services for diabetic retinopathy. In Ethiopia screening for diabetic retinopathy was done only in the capital, which showed 37.4% prevalence of DR.[12] There has been no data about the prevalence of diabetic retinopathy in the rural Ethiopia including the study area (South west part of the country.)

2 Rationale

The magnitude of visual complications of diabetes mellitus in Jimma University Hospital is not known, and this study establishes the nature and magnitude of diabetic retinopathy in order to provide a basis for specific intervention of diabetic retinopathy in Jimma University Hospital.

3 Objectives

3.1 General objective

To determine the magnitude of diabetic retinopathy in diabetic patients attending medical diabetic clinic of Jimma University Hospital (JUH).

3.2 Specific objectives

1. To determine the prevalence of Diabetic retinopathy in Diabetic patients attending JUH diabetic clinic

2. To determine the pattern of Diabetic Retinopathy by standardised grading using the ETDRS guidelines.

3. To determine the association between Diabetic Retinopathy and the following risk factors:

    (i) Duration of diabetes

    (ii) Glycaemic control

    (iii) Blood pressure.

4 Research Methods and Materials

4.1 Study design

A Hospital based cross sectional study in Jimma university hospital, Jimma, Ethiopia

4.2 Population.

Source Population: All patients attending at Jimma University Hospital during the study period.

Study population: All diabetic patients attending medical diabetic clinic during the study period

4.3 Study setting

Jimma University Hospital is a government university hospital found in south-west part of the country, 335km from the capital. It is the largest hospital in South West Ethiopia with total bed capacity of about 400, and a total catchments area of about 9.5 million. It has a medical diabetic clinic which runs twice a week, where an average of 60-70 patients is seen each day.

4.4 Study period

The study was carried out from February to March 2009.

4.5 Sample size

The sample size was determined using the following formula:

$$n = Z^2_{crit} * P(1-P)/D^2$$

Where n = required sample size

P = estimated prevalence of diabetic retinopathy in Addis Ababa, Ethiopia (38%)

D = Precision of the Study set at 0.05

Z_{crit} is the cut off points along the x-axis of the standard normal probability distribution that represents probabilities matching the 95% confidence interval (1.96). Using this formula, the minimum sample size was found to be 363 patients.

4.6 Sampling method

In each day, about 60-70 patients are seen in the diabetic clinic. To cover the sample size in the study period, the researcher has to see at least 32 patients each clinic day. Systematic sampling was used to identify the study subjects. The daily registry was used and every other patient was picked from the daily registry for the study. A lottery method was used to pick the first patient for each day.

4.7 Inclusion criteria

All diagnosed diabetic patients aged 12 years and older, who were attending medical diabetic clinic during the study period.

4.8 Exclusion criteria

1. Opaque ocular media not allowing adequate visualization of the fundus for grading of diabetic retinopathy.

2. Diabetic children aged less than 12 years.

3. Those who declined to give consent.

4.9 Materials

- Structured questionnaire was used for data collection

- Tropicamide 1% eye drops

- Snellen's chart, Slit lamp,

- Indirect binocular ophthalmoscope, 20D and 90D Volk loupes.

4.10 Data Collection Procedure.

Patients were recruited from the medical diabetic clinic when they came for visiting the physicians. Using the systematic sampling, in this case every other patient was selected making use of the daily registry system on the booking order list. Those patients who were selected were taken to Eye unit. Informed written consent was obtained; then demographic data entered on the questionnaire and blood sample for FBS was then obtained. The patient's blood pressure was measured in sitting position, after 5-10 minutes of rest using an automatic wrist BP machine. Hypertension was defined as systolic BP of $\geq$140mmHg, and a Diastolic Bp of $\geq$90 mmHg.

Visual acuity was assessed for each eye using Snellen's chart at 6metres, E-chart was used for those who can't read numbers on Snellen's chart. Subjective refraction was attempted for those with vision of less than 6/6 by an ophthalmic nurse. Anterior segment examination using a slit lamp (HAAG Streit Bern 90032747, Swiss Made) was carried out before dilated fundus examination. The pupils were then dilated using 1% tropicamide eye drops and posterior segment examined using a binocular indirect ophthalmoscope(HEINE EN50®, Germany) and 20D loupe, after which stereoscopic binocular examination of the fundus using a slit lamp and a

90D loupe was carried out. Slit lamp examination and fundus evaluation was carried out by the principal investigator, and cross checking of findings were done by an ophthalmologist. After examination, the findings were explained to the patient, and those requiring treatment were treated. Those who required Laser or retinal surgery were referred.

4.11 Data analysis and presentation

After cross checking the questionnaires for any missing entries, data was coded and entered to SPSS version 16 for analysis. The results of the study are presented in forms of tables, histograms, and pie charts.

4.12 Ethical considerations.

Ethical approval was obtained from the ethics committee of Jimma University Hospital and informed consent was obtained from the patients or next of kin prior to data collection. The effects of drugs, for example, the temporary effect of tropicamide eye drops on accommodation and any inherent danger of driving were explained to the patients. All eye drops used were registered in Ethiopia. Confidentiality of patients' records was strictly observed, and only the researcher had access to the data. Those requiring treatment were treated or referred.

5 Results

A total of 324 patients were examined out of the calculated sample of 363. Males constituted 59.3% of study participants.

Majority of the study subjects were type II diabetics (72.8%), 27.8% had type I diabetes.

Fig 1. Distribution of Patients by Age, (n=324)
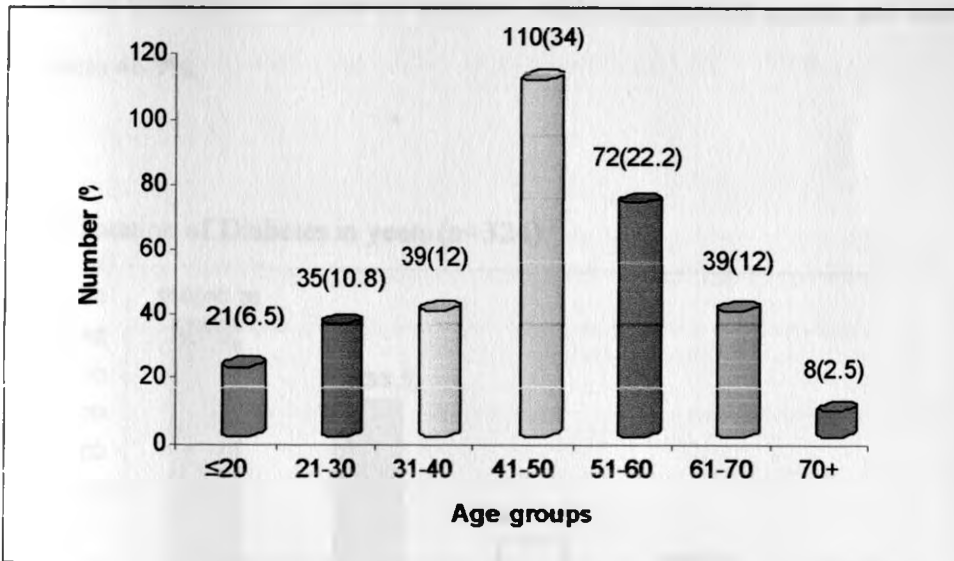
The mean age was found to be 46.14 (SD 15) years.

Figure 2. Modality of treatment the patients are getting (n=324)
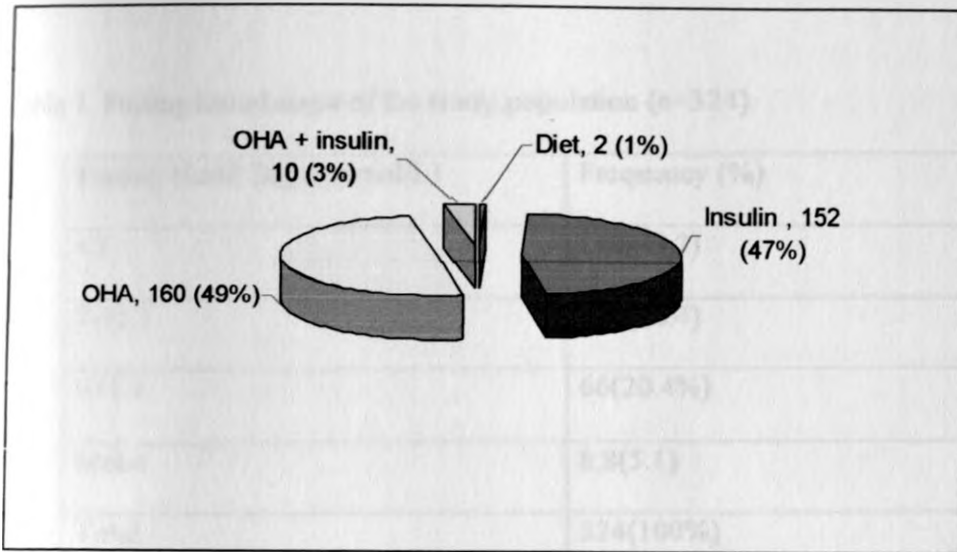
About half (49.4%) of the patients were on Oral hypoglycemic agents, and while those on insulin constitute 46.9%.

Fig 3. Duration of Diabetes in years (n=324)

The mean duration of diabetes mellitus 6.26 years, (Std Deviation 5.5)

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Table 1. Fasting blood sugar of the study population (n=324)

Fasting blood Sugar(mmol/L)	Frequency (%)
<7	140(43.2)
7-11.1	118(36.4)
>11.1	66(20.4%)
Mean	8.8(5.1)
Total	324(100%)

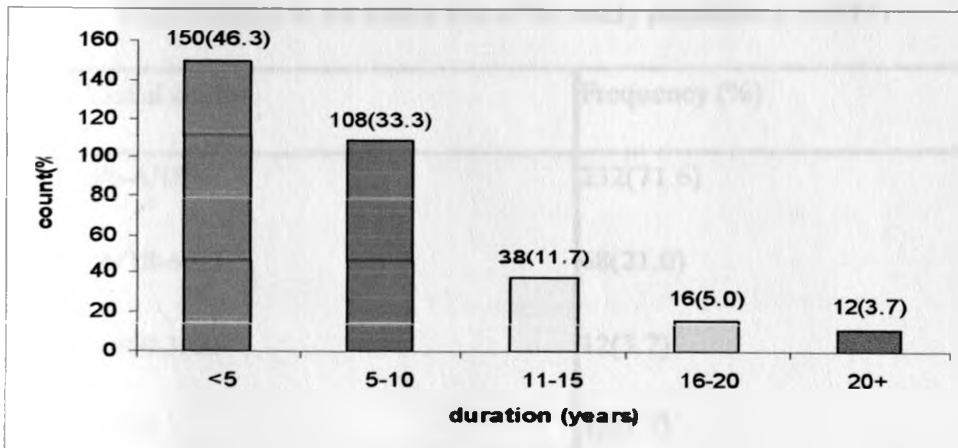The mean fasting blood sugar was found to be 8.8mmol/L (158.8mg/dl), Standard deviation of 91.2, (5.1mmol/L).

Table 2. Visual acuity in the better eye of the study population (n=324).

Visual acuity	Frequency (%)
6/6-6/18	232(71.6)
<6/18-6/60	68(21.0)
<6/60-3/60	12(3.7)
<3/60	12(3.7)
Total	324(100)

Among study subjects 28.4% were found to have visual impairment, 3.7% are blind.

Table 3. Classification of diabetic retinopathy in the most affected eye (n=324)

Diabetic Retinopathy	Frequency	Percent
1. Normal (No DR)	190	58.6
2. Minimal NPDR with out macula edema.	62	19.1
3. NPDR with ME not CSME	41	12.7
4. NPDR with CSME	16	4.9
5. Sever NPDR	7	2.2
6. NHRPDR	4	1.2
7. NHRPDR with CSME	2	0.6
8. HRPDR	2	0.6
9. HRPDR not amenable to photocoagulation	0	0.0
Total	324	100%

The prevalence of diabetic retinopathy was found to be 41.4 %.

Table 4. Association between visual acuity (worse eye) and diabetic retinopathy.

Visual Acuity	DR	No DR	OR(95% CI)	P- value
≥ 6/18	56	162	0.12(0.07-0.22)	<0.001
<6/18	78	28		

Patients with DR were found to have poorer visual acuity than those with out DR, and it was statistically significant.

Table 5 .Association between the type of treatment and fasting Blood Sugar (n=312)

Type of Treatment	Mean FBS(mg/dl)	P –Value
Insulin	167.9(9.3mmol/L)	
OHA	148.7(8.3mmol/L)	0.065

Those on insulin were found to have higher FBS than those on OHA, but the difference was not significant.

Table 6. Association of Diabetic Retinopathy with selected variables.

Variable mean(SD)	DR status		p-value
	Yes	No	
Mean age (years)	51.5 (14.6)	42.4 (14.2)	0.04
Duration of DM(years)	9.9 (6.4)	3.6 (2.7)	<0.001
FBS (mg/dl)	168.3 (116.3)	152 (67.7)	0.002
Systolic BP (mmHg)	129 (17.1)	120.2 (15.6)	<0.001
Diastolic BP (mmHg)	80.1 (10.9)	75.2 (9.6)	<0.001

The above table shows that there is statistically significant association between diabetic retinopathy and fasting blood sugar, mean age, systemic BP and duration of diabetes.

6 Discussion

Diabetic retinopathy is becoming a major cause of blindness worldwide in age groups of 20-60years and the incidence and its complications are rising in these countries.[2] Measures to reduce visual disabilities and improve quality of life of those affected have become important, and so is the need for information on diabetic retinopathy in developing world. The magnitude of Diabetic retinopathy in rural Ethiopia has not been described before including the study area. This study is therefore helpful in providing baseline data for planning and organizing a regularly running diabetic clinic in the eye unit.

Majority of the patients seen were males (59.3%), despite the fact that females contribute about 52% of Ethiopian population. It was difficult to establish why there were more males than females in this study but there was no association between sex of the patient and occurrence of diabetic retinopathy.

In our study the prevalence of diabetic retinopathy was found to be 41.4%. Different studies done in the region have shown similar figures. A study done in Addis Ababa by Syoum showed the prevalence of diabetic retinopathy to be 38% which is a close figure to the result of this study[12]. In Kenyatta National Hospital Karuiki et al found a higher figure than this study(49.8%), this could partly be explained by the possible fact that Kenyatta is a referral center and those with long term disease and complication tend to be followed here.[24] In rural Kenya, a study by Kibata et al among diabetics attending peripheral health institutions showed a prevalence of 18.3%, which is much lower than in our study.[51]

The high prevalence of diabetic retinopathy in our study could partly be explained by the fact that only 43.2 % of patients had their blood sugars well controlled. The rest of the study participants were found to have poor glycemic control. It was not easy to point out the reasons why these patients had such a poor control of blood sugar. This warrants a study to assess the reasons of poor control

The prevalence of both severe NPDR(2.2%) and clinically significant macular edema(7.3%) was higher than that of Syoum's study in Addis Ababa and other studies in the region.[12] Vision threatening retinopathy (defined as presence of PDR or macular edema) was present in 24 (7.3%) of the diabetic patients. Eight patients were found to have PDR (2.4%), which is a higher than the study done in Addis Ababa which found a PDR prevalence of 1.7%[12]. These higher rates could as well be partly explained by the fact that most study subjects had poor sugar control, which was well above the cut off point to avoid or delay diabetic micro-angiopathy. Those with vision threatening diabetic retinopathy (7.3%) needed immediate laser photo-coagulation treatment according to ETDRS. Despite this fact there is no laser photocoagulation facility in Jimma University eye unit and patients have to travel more than 300km to the capital to get the service. During the study only two patients had managed to travel and have laser photocoagulation treatment in Addis Ababa. Based on the above fact, it is the opinion of the researcher that, Jimma University Eye unit which is currently running a postgraduate program, needs to have at least a photocoagulation laser machine, so that proper service can be delivered and it will as well be a good input for the training.

Among all examined study subjects, only 47(14.5%) patients had previous eye examination by an ophthalmologist. This is an alarmingly low figure when compared to other developing

countries in the region.[12,14,17,51] This might partly reflect the lack of coordination between the eye clinic and medical diabetic clinic.

When looked at the association of diabetic retinopathy with some known factors, it was found out that, duration of diabetes was strongly associated with diabetic retinopathy P<0.001, table 6. These findings correlate well with other studies which pointed out that duration of diabetes is the most important predictor of development of diabetic retinopathy.[28] In a study done in Southern India , the prevalence of diabetic retinopathy was 7% in individuals with a short duration of diabetes(<10 years), but among those whose duration of diabetes was 10-14 years , the prevalence of diabetic retinopathy was 26%. For those patients in whom the duration was >15years or more the prevalence was 63%.[13] In this study there was statistically significant difference between visual acuity of those with diabetic retinopathy and those with out.

The protective effect of long-term glycemic control on the development and progression of diabetic retinopathy has been well documented. It plays an important role in delaying the onset, and retarding the progression of diabetic retinopathy. In this study the fasting blood sugar level and diabetic retinopathy were found to have a statistically significant association (P=0.002).

The best tool to get good information about the long-term blood sugar control is the level of HBA1c in the blood and it was our interest to do HBA1c level for each patient. But there was no facility to do the test in the study area. Only fasting blood sugar was used to assess the level of glycemic control, which usually tells us about the current status of glycemic control, but not about the long term control status.

Concerning mode of treatment of diabetes in Jimma University Hospital, 49% of patients were on oral hypoglycemic agents (OHA), and 47% were on insulin alone. The type II diabetics comprise 72.8% of patients but those on OHA were only 49%, which indicates that more type II diabetics were put on Insulin.

It was also found that those on insulin were having higher FBS than those on OHA, but the difference was not significant p=0.065, table 5. One might expect that those on insulin to have better control of blood sugar, which was not true in our study, may be because those who were on insulin had failed to be controlled on OHA are put on insulin as last resort.

Only 3% of patients were on both treatments. Patients on both modes of treatment had higher prevalence of diabetic retinopathy than those on a single mode of treatment but this was not statistically significant. This could be a reflection of the severity of diabetes since patients with poor control may need more than one mode of treatment.

The number of patients who were found to have hypertension was too few to make a comparison. Upon analysis of the mean systolic and diastolic blood pressures in our study population, it was higher in patients with diabetic retinopathy with a statistically significant difference (Table 6).

Study Limitation

One limitation of this study is that there were no facilities to do HBA1c, which is the recommended mode of testing blood sugar control, leading to the use of fasting blood sugar alone.

7 Conclusions

1 The Prevalence of diabetic retinopathy among diabetics in Jimma University Hospital was high at 41.4% and vision threatening diabetic retinopathy was found to be 7.3%.

2 A very high proportion (85.5%) of patients had no previous eye examination before this study.

3 Longer duration of diabetes, poor glycemic control, and high systemic blood pressure were significantly associated with diabetic retinopathy.

4 Blood sugar control among diabetic patients was found to be poor with a mean fasting blood sugar of 158.7mg/dl.

8 Recommendations

1 There is a need for collaboration between the medical diabetic clinic and the ophthalmic unit for better referral of patients in order to have a screening system for early detection of diabetic retinopathy.

2 A vitreo-retinal unit with laser facilities in Jimma is needed, since a large number of subjects needed laser services, and the nearest is in the capital, 340km away.

3 It would be advisable for the medical unit to be able to do HBA1c.

4 Further research to find out the reasons for poor blood sugar control is recommended.

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Appendix I

<u>Questionnaire</u>   Date................

   A-General   information

Name.. IP/OP No...............

1-Age (in years)................

2-Sex   a) Male   b) Female

3-Duration of diabetes in years........................

4-Type of diabetes   a) Type 1   B) Type 2

5-Diabetes Treatment: Duration.

   a) Diet...................................   ....

   b) O.H.A...   ....

   c) Insulin...........................   ....

6-Any awareness about the effect of DM on the eyes   a) Yes   b) No

7- Any visual complaints a) Yes   b) No

If Yes   a) Reading problem   b) Poor distance vision

   c) Others (specify)... ....

8. Any previous eye examination for the diabetes (a) yes   (b) No

9-Concomitant illness   a) HTN   b) Nephropathy c) Glaucoma   d) Cigarette Smoking   e)

Others_____

Laboratory: **Fasting blood sugar**..................................

B/P (mmhg)..

B- Ocular Examination,

1-Visual Acuity   OD

         Os

2-Refraction(when necessary)

                            _OD_   _OS_

3-Adnexal and anterior segment exam

(Abnormal findings only)

5-Posterior Segment   ....

(Thorough Dilated Exam)

Final assessment of Diabetic Retinopathy:

DIABETIC RETINOPATHY	RE	LE
1. Normal or minimal NPDR		
2. NPDR with macula edema that is not CSME.		
3. NPDR with CSME		
4. Severe NPDR		
5. NHRPDR		
6. NHRPDR with CSME		
8. HRPDR		
9. HRPDR not amenable to photocoagulation		

PLAN (Remarks);

....

Appendix II

ETDRS GRADING OF DIABETIC RETINOPATHY

1. Normal or minimal non proliferative diabetic retinopathy (NPDR).

2. Non proliferative diabetic retinopathy without macula edema.

3. NPDR with macular edema that is not clinically significant.

4. NPDR with clinically significant macular edema (CSME)

CSME is defined by the ETDRS as the following:

5. Severe NPDR (pre-proliferative).

6. Non high risk proliferative diabetic retinopathy without CSME.

7. Non high risk proliferative diabetic retinopathy with clinically significant macula edema (NHRPDR with CSME).

8. High risk proliferative diabetic retinopathy (HRPDR).

9. High risk proliferative diabetic retinopathy not amenable to photocoagulation.