Prevalence, risk factors and causes of visual impairment in patients with diabetes at Mbarara Regional Referral Hospital, South Western Uganda; A hospital based study

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ABSTRACT

Objective: To determine the prevalence, causes and risk factors to visual impairment among patients with diabetes at Mbarara Regional Referral Hospital (MRRH) as a baseline pilot for developing diabetic retinopathy treatment services.
Design: This was a descriptive cross sectional hospital based study conducted for a period of six months.
Methods: In a cross-sectional study done at Mbarara Regional Referral Hospital, 318 patients with diabetes aged 18 years and above were enrolled. Their visual acuity was determined. Those that had visual acuity of below 6/18 underwent a detailed ocular exam including refraction and a dilated fundoscopy to determine the cause of visual impairment.
Results: The prevalence of visual impairment was 28.6% without correction, and 17% with correction. Cataract was the commonest cause of visual impairment (34.5%) followed by refractive error (20.8%), glaucoma (16.8%) and diabetic retinopathy (12.5%). Age was the only significant risk factor to visual impairment in this population.
Conclusion: The proportion of visual impairment was high and cataract was the commonest cause of visual impairment in this population.

INTRODUCTION

*Study location***:** The study was conducted from the diabetic clinic of Mbarara Regional Referral Hospital. MRRH is located in Mbarara Municipality South western Uganda about 300 km from the capital Kampala. It receives patients mainly from south western Uganda, parts of western Tanzania, northern Rwanda, and eastern Democratic Republic of Congo. The diabetes clinic runs once a week under the Internal Medicine department. Routine practise in the clinic is as follows: the patients' registration for consultation starts at 8.00 am with nurses taking vital signs and testing blood sugar level, and consultations start at 9.00 am up to 4.00 pm. Patients come for blood sugar control, drug refills, consultations and also registration of new patients. Diabetes clinic is one of the busiest consultation clinics in the hospital and it attracts approximately 150 to 250 patients per consultation day.
Study population: The study population was comprised of all adult patients with diabetes that were 18 years and above, attending the diabetes clinic of MRRH during the specified study period. According to annual clinical records at the clinic, 1700 patients with diabetes were registered in the year 2013; they were mainly spread from areas around Mbarara Town in south western Uganda. MRRH is the regional referral and has a catchment of approximately 10 million people.

*Sample size***:** A sample size of 318 patients to give a power of 80% and precision of 95% was used.
*Inclusion criteria***:** All adult patients with diabetes (18 years and above) who consented to participate during the scheduled study period.
Exclusion criteria:

- All adult diabetic patients with mental disorders
- Restricted patients such as prisoners and refugees
- Patients who were critically ill

MATERIALS AND METHODS

*Sampling methods***:** Systematic random sampling was employed. With a modest estimation of a daily clinic attendance of 150 patients, and projected pretested data collection capacity of 30 patients per clinic day, a sampling interval not exceeding 5 was calculated. Patients register on the clinic day was used as the sampling frame. A raffle with numbers 1-30 would be drawn at the beginning of each clinic session where the principal investigator randomly chose a patient number to start with. He would then instruct the nurse to pick every 5th patient from the starting number and send him/her to the eye examination room where informed consent, questionnaire administration and eye examination were done.
*Data collection***:** The principal investigator obtained consent from them to participate, using the language

that the patient was comfortable with. After that, the patient's demographic data was recorded by a research assistant. The assistant also recorded patients' height, weight and blood sugar directly from their diabetic attendance record book. Then the patient underwent ocular examination by the principal investigator. This would include visual acuity, refraction, anterior segment examination, tonometry, pupil dilatation and funduscopy with 90D/78D/indirect ophthalmoscope. Visual acuity was collected using Snellen's E chart at 6 metres and recorded in fraction notation, refraction was initially done using a manual Heine retinoscopy for distance vision and subjective for near vision and recorded in best corrected spherocylindircal notation. However, because of time constraints, this was replaced with pinhole visual acuity testing as a proxy indicator of refractive error. Anterior segment was done using an appasamy model slit lamp and data recorded on corneal opacity, anterior chamber depth, activity, pupil reactions and cataract. Tonometry was then done with Goldman applanation tonometer and recorded as mmHg. Pupil dilatation was done after using cocktail epinephrine and cyclopentolate eye drops for funduscopy using a 90D condensing lens on a slit lamp for detailed posterior segment. Data was collected on cup disc ratio, features of DR (haemorrhages, exudates, new vessels, macular oedema) and any other pathology. For complicated cases, the principal researcher would call a senior ophthalmologist from the department of ophthalmology for a second opinion. Patients who would have already participated in the study would have their files at the diabetes clinic marked to avoid risk of picking on them on the subsequent sessions. In collaboration with the staff at the diabetes clinic, we ensured that any patient who participated in the study, at the end of ocular examination, he/she was facilitated to join his position on consultation list without any unnecessary delays.

Data management and analysis: Data was entered into Microsoft Excel, and later exported into STATA 11.0 for analysis. A systematic analytic plan was as follows:

(i) For the baseline characteristics; univariate analysis using one-way tables of frequencies was used to generate tabulations.
(ii) To determine prevalence of visual impairment among patients with diabetes at MRRH, univariate analysis using one-way tables of frequencies was used to generate tabulations.
(iii) To determine the cause of visual impairment among patients with diabetes at MRRH, univariate analysis using one-way tables of frequencies was used to generate tabulations.

Quality assurance: A questionnaire was pretested several times on participants who were not included in the data collected. We worked hand in hand with a senior ophthalmologist from the department of ophthalmology to validate our diagnoses. Questionnaires were administered uniformly to avoid bias of over reporting. Data was double checked before entry by the principal investigator. Patients who had already participated in the study, their files at the diabetic clinic were marked to avoid risk of picking on the same participant in the subsequent sessions. Questionnaires were verified by the principal investigator after field work.

*Ethical consideration***:** Approvals were sought from the Departments of Ophthalmology and Internal Medicine, Faculty Research and Ethics Committee and Institutional Ethical Review Committee of Mbarara University of Science and Technology (IRB NO:14/11-13). Informed consent was obtained from the participants as per the Ethical Committee guidelines.

Limitations: The following were the limitations of our study;

(i) Our study lacked fundus camera among the equipment to document abnormal fundoscopy findings which would have made making diagnosis more interactive if shared by other specialists.
(ii) Majority of eye diseases we encountered was cataract. In patients who had dense cataract, it was not possible to examine their fundi hence possibility of missing out posterior segment eye conditions such as diabetic retinopathy.
(iii) The study was unable to do visual fields to confirm glaucoma; diagnosis was mainly based on optic disc cupping and IOP measurements.

Despite these limitations, we believe that the sample size of our study and the degree of confidence around our findings rendered them useful.

RESULTS

A total of 318 study participants were enrolled for this study between September 2013 and March 2014 from MRRH.

Demographic characteristics of the study population: Demographic characteristics of the diabetic patients identified are shown in Table 1. A total of 318 patients were identified in this study. The mean age of study participants was 56 years (95% CI 42-70); the male to female ratio was 1:2; 229 (72%) patients came from the rural parts of Mbarara; 214 (67.3%) of the patients were married; only 30 (9.4%) of the patients had attained tertiary education; and 172 (54.1%) of the patients were casual labourers.

Table 1: Demographic characteristics of study participants (n=318)

Characteristics	Frequency n (%)
Sex	
Male	107 (33.7)
Female	211 (66.4)
Residence	
Town (5km)	89 (28)
Rural (>5km)	229 (72)
Age (years)	
<35	25 (7.9)
35-49	83 (26.1)
50-59	74 (23.3)
>60	136 (42.8)
Marital status	
Married	214 (67.3)
Widowed	71 (22.3)
Divorced	21 (6.6)
Single	12 (3.8)
Education level	
Primary	162 (50.9)
Secondary	35 (11.0)
Tertiary	30 (9.4)
No education	91 (28.6)
Occupation	
Casual laborers	172 (54.1)
Business	56 (17.6)
Professional	25 (7.9)
House wife	32 (7.2)
Retired	30 (9.4)
Unemployed	12 (3.7)

Proportion of visual impairment among patients with diabetes: The proportion of visual impairment (VA worse than 6/18) was found to be 28.6 % without correction and 17% with correction (Table 2).

Table 2: Proportion of visual impairment without correction and with correction (n=318)

	Without correction n (%)	With correction n (%)
Visual impairment	91 (28.6)	54 (17)
No visual impairment	227 (71.4)	264 (83)
Total	318 (100)	318 (100)

*Pattern of eye diseases among patients with diabetes at MRRH diabetes clinic***:** The most common eye disease amongst study participants was found to be cataract as shown in Table 3.

Table 3: The pattern of eye diseases among patients with diabetes at MRRH diabetes clinic (n = 168)

Eye disease	n (%)
Cataract	58 (34.5)
Refractive error	35 (20.8)
Diabetic retinopathy	28 (16.8)
Glaucoma	21 (12.5)
Others	26 (15.5)
Total	168 (100)

Table 4: Shows risk factors for visual impairment among patients with diabetes at MRRH diabetes clinic (bivariate analysis n=318)

Variable	Variable category	OR (95%CI)	p
Gender	Male	1	
	Female	0.9 (0.5-1.5)	0.72
Age (years)	<35	1	
	35-49	5.7 (0.7-45.5)	0.09
	50-59	7.7 (0.9-61.1)	0.05
	>59	16.8 (2.2-127.8)	0.01
Place of residence	Urban	1	
	Rural	1.1 (0.6-1.9)	0.68
Marital status	Married	1	
	Widowed	1.2 (0.7-2.2)	0.48
	Divorced	1.3 (0.5-3.3)	0.61
	Single	0.2 (0.1-1.9)	0.12
Religion	Protestant	1	
	Catholic	1.8 (0.9-3.5)	0.07
	Muslim	0.9 (0.3-2.7)	0.87
	Others	0.7 (0.4-1.4)	0.44
Education	No education	1	
	Primary	0.6 (0.2-1.5)	0.28
	Secondary	1.2 (0.5-2.9)	0.64
	Tertiary	1.7 (1.0- 3.0)	0.06
Occupation	Laborer	1	
	Business	0.7 (0.4-1.6)	1.57
	Professional	0.2 (0.1-2.4)	2.43
	House wife	1.0 (0.4-2.7)	2.67
	Unemployed	1.8 (0.8-4.0)	4.00
	Retired	1.6 (0.2-1.7)	1.67

Table 4: Continued

History of hypertension	No hypertension		
	Hypertension	1.7(1.1-2.8)	0.04
HIV status	Negative	1	
	Positive	2.5 (0.8-7.8)	1.61
	Unknown	1.9 (1.1-3.5)	0.03
BMI	Underweight	1	
	Normal	0.9 (0.2-4.0)	0.95
	Overweight	1.0 (0.2-4.2)	1
	Obese	0.3 (0.8-1.8)	0.23
Blood sugar (n=317)	Normal	1	
	Hyperglycemia	1.0 (0.6-1.8)	0.7
	Asymptomatic	1	
Visual symptoms	Symptomatic	4.2(2.1-10.7)	0.01
	Screened	1	
Screening behaviour	Never screened	1.8 (1.1-3.0)	0.02
History of alcohol	No alcohol	1	
	Drinks alcohol	1.1 (0.5-2.6)	0.8
History of smoking	None smoker	1	
	Smoker	1.5 (0.9-2.5)	0.13
Type of treatment	Insulin	1	
	Tablets	0.8 (0.1-8.6)	0.91
	Diet	1.4 (0.7-3.0)	0.35

From bivariate analysis, factors which showed significant association with a visual impairment were: age, history of visual complaint on presentation, history of hypertension, HIV status, and screening behaviour.

Table 5: Shows risk factors for visual impairment among patients with diabetes at MRRH diabetes clinic on multivariate analysis (n=318)

Variable	Variable category	OR (95%CI)	P
Visual complaint on presentation	Asymptomatic	1	
	Symptomatic	4.4(1.9-10.5)	0.01
Age category	<35	1	
	35-49	4.3(0.5-36.1)	0.17
	50-59	5.3(0.6-44.2)	0.12
	>60	10.4(1.3-85.4)	0.03
HIV status	Negative	1	
	Positive	2.8 (0.7-7.3)	0.60
	Unknown	1.5 (0.8-3.1)	0.09
History of Hypertension	No hypertension	1	
	Hypertension	1.2 (0.6-2.1)	0.61
Screening behaviour	Screening	1	
	No screening	1.2 (0.7-2.1)	0.49

P<0.05 was considered statistically significant

From multivariate analysis, the only risk factors which showed strong association with visual impairment were age and presence of visual complaint at time of presentation. The odds of visual impairment for an older patient (>60 years) with diabetes were almost 10 times more than younger patients (<35 years) (p=0.04). The odds of visual impairment for patients who had visual complaints at the time of enrolment (presentation) were almost five times more than for the patients without visual symptoms on presentation (p<0.01). Screening behaviour, HIV status and history of hypertension were not significant risk factors after multivariate analysis.

DISCUSSION

Worldwide, there are estimated 366 million people living with diabetes. By 2030 this number will have risen to 552 million. That is an increase of 54%[1]. It is expected that during the same period, visual impairment among patients with diabetes will also increase if necessary measures are not taken to prevent diabetes-related visual impairment[2]. Prevalence of diabetes type 2 in Uganda is 8.1%[3] , however prevalence for type 1 diabetes is not known. Before this study, the proportion of visual impairment among patients with diabetes in Uganda was not known. There are visual impairing eye diseases commonly associated with diabetes. The commonest ones are diabetic retinopathy, cataract, glaucoma, and others[4-8]. Their distribution patterns tend to vary from one place to another. To our knowledge, this was one of the first hospital-based studies to establish patterns of visual impairment among patients with diabetes in south western Uganda.

Proportion of visual impairment among patients with diabetes at MRRH diabetes clinic: The proportion of visual impairment among patients with diabetes in this population was high (29%) compared to that in Northern Africa of 22%[9]. However, it was almost three times more than what was found in a hospital based survey among diabetes patients at diabetes outpatient clinic at QECH, Blantyre of about 12%[10]. However it was almost three times less than what was reported in South Africa (64%)[11]. The difference in prevalence between our population and that of Malawi and that of South Africa could be in the different socio economic lifestyles. It was not possible to compare with other parts of East Africa because of paucity of information. The true significance of the proportion of the visual impairment in our population could not be properly interpreted because we did not have baseline reference for Uganda or any other close country in the region. In time when another study is done, we shall be able to comment whether the proportion of visual impairment is rising or reducing in our population. From our data, we saw that 40% of the patients showed

improvement of vision on refraction, however, it was not possible to comment on whether this was associated with control of blood sugar or an underlying refractive error.

Distribution pattern of eye diseases among patients with diabetes at MRRH diabetes clinic: The distribution pattern of eye diseases among patients with diabetes at MRRH diabetes clinic, agreed with other studies done elsewhere. In a study at Mulago Hospital Eye Department, Uganda, cataract was the most prevalent eye condition among patients with diabetes (37.7%), diabetic retinopathy followed with (35.2%)[12]. A similar study in two West African countries of Ghana and Nigeria was done and cataract was still commonest (44.9%), diabetic retinopathy (17.9%)[13].

Risk factors for visual impairment among patients with diabetes at MRRH diabetes clinic: This study showed that visual impairment was significantly associated with older age, and having visual symptoms at time of presentation ($p<0.05$). These findings were consistent with other studies[14,15]. However, we did not find association of factors like duration of diabetes, type of diabetes treatment, body mass index, female gender, with visual impairment that was earlier reported in studies quoted above. We recognized the limitations of our study. It is possible that our study could have underestimated true association of other factors.

CONCLUSIONS AND RECOMMENDATIONS

Our results could not be generalizable to Uganda since this was a study mainly in rural south western Uganda and most patients came from within this catchment area. Therefore, the true prevalence for Uganda could be different. However, based on the findings of the study, the following conclusions were drawn:

(i) The proportion of visual impairment among patients with diabetes was high. There is urgent need to look at this as a public health concern in Mbarara area and interventions put in place.

(ii) Cataract, refractive errors, and diabetic retinopathy were the most common eye conditions among patients with diabetes, affordable cataract services should be provided to this population. However, diabetic retinopathy causes irreversible visual loss, there is need for more efforts to sensitise improve diabetic retinopathy screening and treatment in MRRH. Older age and having visual complaints at the time of presentation were the only significant factors associated with visual impairment; however, this was not conclusive. There is need for more studies in risk factors of visual impairment in diabetic patients at MRRH.

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REFERENCES

1. Federation ID. International Diabetes Federation, IDF World Atlas Fifth Edition, 'The Global Burden',. IDF; 2011 [cited 2012 12th Dec]; Fifth:[Available from: http://www.idf.org/diabetesatlas/5e/the-global-burden.
2. Resnikoff S, Pascolini D, Etya'ale D, Kocur I, Pararajasegaram R, *et al*. Global data on visual impairment in the year 2002. *Bull World Health Org*. 2004; **82**(11):844-851.
3. Nandutu G. Factors affecting adherence to nutrition therapy by type 11 diabetics attending Mulago Hospital diabetic clinic, [Dissertation] Kampala, Uganda. 2008.
4. Sjolie AK. Ocular complications in insulin treated diabetes-mellitus-an epidemiological-study. *Acta Ophthalmologica*. 1985; **63**:1-77.
5. Sjølie AK, Stephenson J, Aldington S, Kohner E, Janka H, *et al*. Retinopathy and vision loss in insulin-dependent diabetes in Europe: the EURODIAB IDDM complications study. *Ophthalmology.* 1997; **104**(2):252-260.
6. Brechner RJ, Cowie CC, Howie LJ, Herman WH, Will JC, Harris MI. Ophthalmic examination among adults with diagnosed diabetes mellitus. *JAMA*. 1993; **270**(14):1714-1718.
7. Herse P. A review of manifestations of diabetes mellitus in the anterior eye and cornea. *Amer J Optometry Physiological Optics*. 1988; **65**(3):224-230.
8. Klein BE, Klein R, Wang Q, Moss SE. Older-onset diabetes and lens opacities. The Beaver Dam Eye Study. *Ophthal Epidemiol*. 1995; **2**(1):49-55.
9. Kahloun R, Jelliti B, Zaouali S, Attia S, Ben Yahia S, Resnikoff S, *et* al. Prevalence and causes of visual impairment in diabetic patients in Tunisia, North Africa. *Eye* (Lond). 2014; **28**(8):986-991. Epub 2014/06/14.
10. Glover SJ, Burgess PI, Cohen DB, Harding SP, Hofland HW, *et al*. Prevalence of diabetic retinopathy, cataract and visual impairment in patients with diabetes in sub-Saharan Africa. *Br J Ophthal*. 2012; **96**(2):156-161.
11. Mabaso R, Oduntan O. Prevalence and causes of visual impairment and blindness among adults with diabetes mellitus aged 40 years and older receiving treatment at government health facilities in the Mopani District, South Africa. *Afr Vision Eye Health*. 2014; **73**(1):8-15.
12. Nabatanzi C. Pattern of ocular manifestations among diabetics at Mulago Eye Clinic [dissertation]. Kampala: Makerere University; 1999.
13. Rotimi C, Daniel H, Zhou J, Obisesan A, Chen G, Chen Y, *et al*. Prevalence and determinants of diabetic retinopathy and cataracts in West African type 2 diabetes patients. *Ethnicity Dis*. 2003;**13** (2; SUPP/2):S2-110.
14. Zhang X, Cheng Y. Diabetes mellitus and visual impairment: National health and nutrition examination survey 1999-2004. *J Ophthalmol.* 2008; **126**(10):1421-1427.
15. Al-Bdour MD, Al-Till MI, Samra KMA. Risk factors for diabetic retinopathy among Jordanian diabetics. *East Afr J Ophthalmol*. 2008;**15**(2):77.