

# Causes and Risk Factors of Visual Impairment In Type 2 Diabetes Mellitus at King Hussein Medical Center.

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## ABSTRACT

**Objectives:** To investigate the causes of severe visual impairment among Jordanians with type II diabetes mellitus and its associated systemic factors.

**Methods:** A prospective study conducted at King Hussein Medical Center between January 2016 and May 2017. After getting the ethical approval and taking a consent form, all patients with type II diabetes mellitus who attended the medical retina clinic in the ophthalmology department and found to have best corrected visual acuity (BCVA) of less than 6/12 in the best eye were included in the study. The patients were subjected to detailed ophthalmic exam including best corrected visual acuity using Snellen chart, anterior segment exam using slit lamp bio-microscopy, intra-ocular pressure measurement using Goldmann applanation tonometry and posterior segment exam using 78 and 90 diopter lens. The patients were divided into two groups; Group A where the best corrected vision in the good eye is 6/60 or worse and Group B where vision in the good eye is less than 6/12 and better than 6/60. The outcome of ocular exam in both groups was recorded and compared and the overall data were analyzed using the Excel.

**Results:** Ninety- three patients aged between 43 and 80 years (mean  $63.1 \pm 12$ ) were included in the study, 55% of them were males with a ratio of 1.2: 1. The duration of Diabetes Mellitus (DM) ranged between 5 and 30 years (mean  $14.4 \pm 5$  years). The hemoglobin A1c (HbA1c) ranged between 6.2% and 12% (mean  $8.7 \pm 1.2$ ). Sixty- five patient (70%) had BCVA less than 6/12 and better than 6/60 while 28 patients (30%) had BCVA of 6/60 or less. In Group A, 20 patients (70.4%) had proliferative diabetic retinopathy (PDR) while the remaining patients had non- proliferative diabetic retinopathy (NPDR). On the other hand PDR was found only in 11 patients (16.9%) in Group B, 46 patients (70.8%) in this group had NPDR and 8 patients (12.3%) had no DR. Macular edema was found in 86.2% of patients with severe visual impairment. Hypertension, hyperlipidemia, and renal failure were present in 46%, 19% and 13% of the patients, respectively, and showed statistically significant association with severe visual loss ( $P$  value  $< 0.01$ ). Age more than 63 years and duration of DM more than 10 years also showed significant association.

**Conclusion:** legal blindness is frequently found among Jordanian diabetics at king Hussein Medical Centre. The most common ocular finding in patients with severe visual impairment (best corrected visual acuity is 6/60 or less) is macular edema. Hypertension, hyperlipidemia, renal failure, age more than 63 years and duration of DM more than 10 years showed statistically significant association.

**Key words:** Diabetes mellitus, Risk factors, Visual impairment.

**JRMS April 2018; 25(1):78-82/DOI:10.12816/0046999**

### Introduction

Diabetes mellitus (DM) is one of the major health problems worldwide resulting in morbidity and mortality for affected individuals. Jordan is considered one of the

developing countries with a relatively high prevalence of DM approaching 17.1%.<sup>(1)</sup> Diabetics are vulnerable to serious systemic complications particularly diabetic retinopathy. It is estimated that the prevalence

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Manuscript Received Aug 21, 2017, Accepted Dec 21, 2017.

of diabetic retinopathy (DR) in diabetic patients to be 28.5%, which may result in severe visual impairment (best corrected visual acuity (BCVA) is 6/60 or less).<sup>(2,3)</sup> It is reported that DR is the leading cause of legal blindness ((BCVA) in the best eye is 6/60 or less) in 5-15% of the blinds in the general population and it was ranked as the fifth common preventable cause of moderate to severe visual impairment.<sup>(4,5)</sup> In Jordan the prevalence of blindness in diabetics was reported to be 7.4%.<sup>(6)</sup> Diabetic complications which may adversely affect vision include: cataract, diabetic retinopathy, macular edema, intravitreal hemorrhage, tractional retinal detachment, epiretinal membranes, glaucoma, myopia and/or corneal opacity.<sup>(7)</sup> The aim of this study was to investigate the causes of severe visual impairment among Jordanian diabetics and its associated systemic factors such as hypertension, anemia, smoking, renal failure, hyperlipidemia and pregnancy.

## Methods

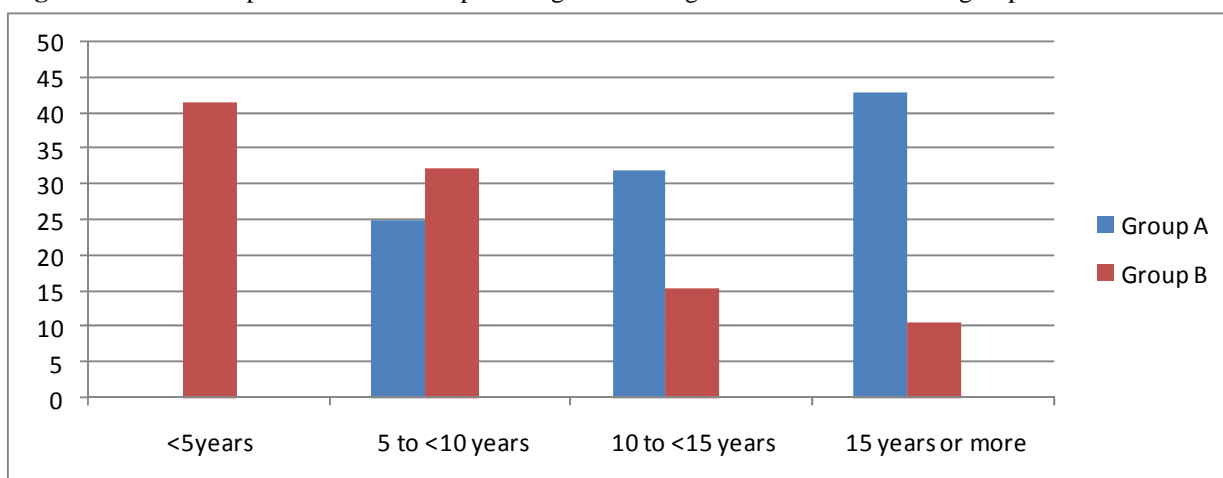
A prospective study conducted at King Hussein Medical Center between January 2016 and May 2017. After getting the ethical approval and taking a consent form, all patients with type II diabetes mellitus who attended the medical retina clinic in the ophthalmology department and found to have BCVA of less than 6/12 in the best eye were included in the study. Patients with ocular trauma or surgery or those who had other ocular diseases which is not related to DM and resulted in visual impairments were excluded from the study. Data were initially collected regarding patient age, gender, duration and control of DM, and the presence of associated risk factors which may play a role in increasing the impact of DM on the eyes. The patients were subjected to detailed ophthalmic exam including BCVA using Snellen chart, anterior segment exam using the slit lamp bio-microscopy, intra-ocular pressure measurement using Golmann applanation tonometry and posterior segment exam using 78 and 90 diopter lens. The patients were divided into two groups; Group A, where the BCVA is 6/60 or worse and Group B, where BCVA is less than 6/12 and better than 6/60. The outcome of ocular exam in both groups was recorded and compared

and the overall data were analyzed using the Excel.

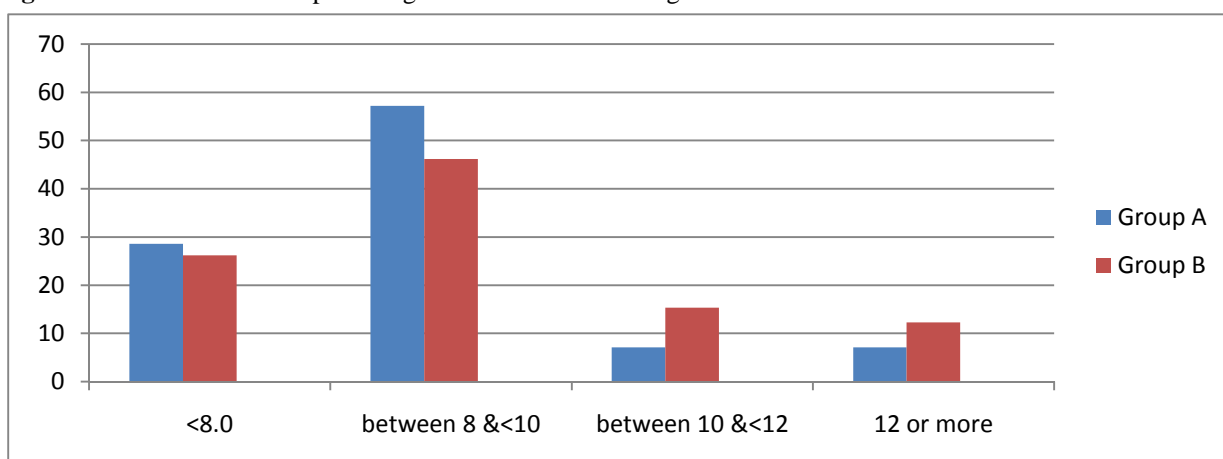
## Results

Ninety- three patients aged between 43 and 80 years (mean  $63.1 \pm 12$ ) were included in the study, 55% of them were males with a ratio of 1.2: 1. The duration of DM ranged between 5 and 30 years (mean  $14.4 \pm 5$  years). Blood sugar control showed tremendous variability among patients. The HbA1c ranged between 6.2% and 12% (mean  $8.7 \pm 1.2$ ). Sixty- five patient (70%) had BCVA less than 6/12 and better than 6/60 while 28 patients (30%) had BCVA of 6/60 or less. Figure- 1 and- 2 summarize the distribution of patients with regard to duration and control of diabetes in both groups. In Group A, 62.5% of patients were on insulin while the remaining patients were on oral hypoglycemic medications, while in Group B, around two thirds of patients were on oral hypoglycemic medications. In Group A, 70.4% of patients had proliferative diabetic retinopathy (PDR) while the remaining patients had non-proliferative diabetic retinopathy (NPDR). On the other hand PDR was found only in 16.9% of patients in Group B, 70.8% of the patients had NPDR and 12.3% had no DR. Macular edema was found in 86.2% of patients which was the most frequent finding in Group A patients, 82% of them had clinically significant macular edema (CSME) while the remaining 18% had non clinically significant macular edema (NCSME). In group B 61.3% had macular edema and one fourth of those had CSME. The outcome of clinical exam is summarized in Table I. In Group A hypertension, hyperlipidemia, and renal failure were present in 46%, 18%, and 14% of patients, respectively, and showed statistically significant association with severe visual loss ( $P$  value  $<0.01$ ). In addition, age more than 63 years and duration of DM (figure 1) more than 10 years also showed significant association ( $P$  value  $<0.01$ ). There was no statistically significant association of smoking, gender, poor blood sugar control (Figure 2) and anemia with severe visual disturbance in diabetics. The risk factors for diabetic retinopathy and visual disturbances among the two groups are summarized in table 2, while the duration and control of DM are shown in figure 1 and 2 respectively.

**Fig 1:** Distribution of patient's number & percentages according to DM duration in both groups.



**Fig 2:** Patient's numbers and percentages distribution according to HbA1c level.



**Table 1:** Ocular findings in both groups

Ocular finding	Percentage in Group A (28 patients)	Percentage in Group B (65 patients)
Macular edema	86.2%	61.3%
Cataract	42.9%	77.4%
Epiretinal membrane	35.7%	6.5%
Vitreous hemorrhage	21.4%	9.7%
Glaucoma	17.8% (14.2% neo-vascular glaucoma)	6.5% (50% neo-vascular glaucoma)
Retinal detachment	7.1%	0.0%
Anterior ischemic optic neuropathy	7.1%	3.25%
Retinal artery or vein occlusion	3.6%	3.25%
Myopia	3.6%	3.25%

**Table II:** The frequency of associated risk factors among Group A and B patients.

Risk factor	Group A (28 patients)	Group B (65 patients)
Hypertension	13(46%)	15(23%)
Hyperlipidemia	5(18%)	5(8%)

Renal failure	4(14%)	3%
Age >63 years	20(71%)	26(40%)
Smoking	12(43%)	30(46%)
Female gender	13(46%)	29(44%)
Anemia	3(11%)	6(9%)

## Discussion

Diabetes and diabetic retinopathy are known to be in rise in the world, the number of vision-threatening diabetic retinopathy is expected to increase from 37.3 million to 56.3 million,<sup>(8,9)</sup> therefore, an increase in the frequency of diabetes related blindness is likely to occur. Effective measures should be taken to control the leading causes of blindness and its associated risk factors so as to avoid such morbidity among diabetics. The mean age of the patients was 63 years. Ajlouni *et al* found the mean age of diabetics in Jordan to be 55 years and Al Till *et al* and Al-Bdour *et al* found that the mean age of diabetics with diabetic retinopathy to be 55 years, which was less than that found in our study for diabetic patients with blindness.<sup>(1,6,10)</sup> This may suggest that age may be considered one of the risk factors for blindness in diabetics. Kahloun *et al* in their study found a significant increase in the risk of blindness in diabetic patients older than 60 years of age.<sup>(7)</sup> About 30% of patients had severe visual loss (6/60 or less) who are considered to be legally blind according to the US Social Security Administration (SSA) definition of legal blindness, while 70% had mild to moderate loss. This result was comparable to that found by Kahloun *et al* where they found that 7.9% of diabetic patients had vision of less than 20/200 and 20.3% had vision between 20/40 and 20/200 and the remaining had vision of better than 20/40.<sup>(7)</sup> Seventy-five percent of patients with severe visual loss had DM duration of 10 years or more compared with only 26% of patients with mild to moderate visual loss. This is explained by the fact that increasing the duration of DM is associated with increasing impact of DM on the eye including PDR and its complications such as epiretinal membrane, vitreous hemorrhage, retinal detachment, macular edema and others which may interfere with vision.<sup>(11)</sup> What supports this conclusion is that PDR was found in

70.4% and 16.9% of patients with severe and mild to moderate visual disturbance, respectively. Blood sugar was better controlled in patients with severe visual loss. That is probably because patients in Jordan donnot often seek for strict control of blood sugar unless they experience significant decline in vision. In addition, 62.5% of patients with severe visual loss were on insulin compared to 33% of those with mild to moderate visual loss although they have much higher HbA1c level. This suggests that early control of blood sugar may prevent severe visual loss later. The most frequent ocular finding found in patients with severe visual loss was macular edema, which was clinically significant in 82% of patients, followed by cataract, epiretinal membranes and vitreous hemorrhage. Diabetic macular edema is a well-known cause of blindness among diabetics,<sup>(12)</sup> on the other hand, cataract was the most common prevalent finding in patients with mild to moderate visual loss. In addition, epiretinal membranes, vitreous hemorrhage, glaucoma particularly neovascular glaucoma and retinal detachment were much more prevalent in patients with severe visual loss. Those findings are much prevalent among patients with PDR.<sup>(13)</sup> The most common associated risk factors for severe visual loss were hypertension, hyperlipidemia and renal failure which were statistically significant. This was consistent with that found in ETDRS.<sup>(14)</sup> These factors are proved to increase the risk of DR in diabetic patients particularly macular edema which was the most common finding seen in patients with severe visual impairment.<sup>(10)</sup> Smoking, gender, poor blood sugar control, and anemia did not show any statistically significant association with severe visual loss although such factors are well known to increase the risk of DR.<sup>(15)</sup> Some recent studies revealed that female gender was significantly associated with visual disturbance.<sup>(16)</sup> Although the burden of severe

visual impairment from DM and diabetic retinopathy is well known globally. This study explored the high frequency of blindness among Jordanian diabetics. Despite the relatively small sample size, this study showed the significant closely association of hypertension, hyperlipidemia, renal failure, long duration of DM, and old age with severe visual impairment. The limitation of this study is that it did not present adequate data regarding the progression of visual loss and outcome of possible treatment due to the relatively short period of follow up.

## Conclusion

Legal blindness is frequently found among Jordanian diabetics at King Hussein Medical Centre. The most common ocular finding in patients with severe visual impairment (BCVA is 6/60 or less) is macular edema. Hypertension, hyperlipidemia, renal failure, age more than 63 years, and duration of DM more than 10 years showed statistical significant association.

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