Research Article

Amsler Grid Test- A Simple Cost Effective Screening Modality for Diabetic Retinopathy

Perwez Khan[1], Priyanka Gupta[2*]
[1]Assistant Professor, Department of Ophthalmology, LLR Hospital, GSVM Medical College, UP, India.
[2]Senior Resident, Department of Ophthalmology, LLR Hospital, GSVM Medical College, UP, India.

*Corresponding author
Priyanka Gupta
Email: priyankagupta8406@gmail.com

Abstract: Routine methods to detect diabetic retinopathy (DR) require expensive setup. There is magnanimous number of undiagnosed diabetics having DR and scarcity of ophthalmologists in rural India. A cheap, easily available and easily understood screening modality is required. Amsler grid has been tried as an effective screening modality in this study. We conducted a randomized, cross sectional study including 146 eyes of diabetics. Based on duration of diabetes mellitus (DM) cases were divided into 3 groups: group A (10-15 years of DM), group B (16-20 years), group C (>20 years). Amsler grid test was performed followed by fundus examination. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) of the test in group A was 48.3%, 80.8%, 84.8% & 41.2% respectively. Sensitivity, specificity, PPV, NPV in group B was 71.9%, 66.7%, 88.5% & 40% respectively. Sensitivity, specificity, PPV, NPV in Group C was 70%, 100%, 100% & 14.2% respectively. Thus, Amsler grid test can be utilized as a cost effective screening modality for diabetic retinopathy. Cases detected by paramedical staff or by self-screening should be referred to ophthalmologist for resultant early diagnosis, better prognosis and reduction in cost of treatment.
Keywords: Amsler grid test, Diabetic retinopathy, screening modality

INTRODUCTION

WHO reported that India has 31.7 million diabetic subjects and the number is expected to increase to 79.4 million by 2030 [1]. Taking into consideration the data calculated by the Chennai Urban Rural Epidemiology (CURES) Eye Study, India has a crude prevalence of DM of 15.5% [2], out of which only 6.1% are diagnosed and 9.1% are undiagnosed [3]. Impaired Glucose Tolerance (IGT) prevalence is 10.6% out of which 14% have a high risk of conversion to diabetes mellitus (DM) [2]. Even though the prevalence of diabetes retinopathy (DR) is only 17.6% 4 but taking into account that India is the diabetic capital and houses about 31.7million diabetics the net number of people with DR amounts to 5.6 million. Similarly with the prevalence of Diabetic Macular Edema (DME) to be 5% [4], net number of patients suffering from DME amounts to be 1.58 million people. This is because of the fact that DME is present in 38% of eyes with moderate to severe non-proliferative DR and reaches 71% in eyes with proliferative DR [5]. Lack of symptoms and the insidious onset of type 2 diabetes may result in inability to suspect the disease and hence development of DR at an early stage[6]. India has low prevalence of self-reported DM which is only 7.3% in urban population, 3.2% in peri-urban/slums, and 3.1% in rural India[7]. The retina may be examined by ophthalmoscopy and slit lamp biomicroscopy using 90 D lens or by using fundus photograph[8]. Recently several noninvasive techniques have come up to improve diagnostic sensitivity. One such technique is the optical coherence tomography (OCT). This method co-relates well with fundus fluorescein angiography (FFA)[9]. These investigations need an elaborate setup and ophthalmologists hence are not cost effective and reasonable. Studies have confirmed that the clinical outcome is better if patients are screened and treated early[10]. According to the data, in India the ophthalmologist-to-population ratio is estimated to be close to 1 per 219,000 in rural areas [11] where about 77% of the population resides. Taking into account the magnanimous number of unreported and undiagnosed diabetics having DR and the bleak ratio of the ophthalmologists and population in rural India there is a burning need for a cost effective, easily available and easily comprehended screening modality which can be made freely available to the rural population. The Amsler grid test seems to fit the bill and has been tried as an effective screening modality in this study.

METHODS:

It was a randomized, cross sectional study. Known diabetic patients attending diabetes OPD in a tertiary care hospital were included in the study. Our

study followed principles in the Declaration of Helsinki. All the subjects were above 40 years of age. They had never undergone ocular or fundal examination before. Best refractive correction of all the subjects was done. Patients having BCVA < 6/60 and near vision < N.36 were excluded from the study as they will not be able to perform Amsler Grid test.

Based on duration of diabetes (DM), cases were divided into 3 groups:
>   **Group A (10-15 years duration),**
>   **Group B (16-20 years duration),**
>   **Group C (>20 years duration).**

Amsler grid chart was given to each subject. Each eye was examined separately. They were instructed to concentrate on the central black dot and following three questions were asked.

1. Do any of the lines look wavy, blurred or distorted?
2. Is there any missing or dark area?
3. Is the side or corner of the grid missing?

If the answer to any of these question was "YES" then the subject was included in the Amsler grid test positive (AG +) group else in the Amsler grid test negative (AG –) group.

All the subjects then underwent fundus examination by 90 D and Indirect Ophthalmoscopy examination. Taking the early treatment diabetic retinopathy study (ETDRS) classification as the reference any patient having diabetic retinopathy changes was included in the diabetic retinopathy present (DR +) group else in the diabetic retinopathy absent (DR -) group.

RESULTS AND DISCUSSION:
146 eyes of diabetics were included in the study.

Group A (DM of 10-15 years duration) comprised of 84 eyes. Amsler grid (AG) test was positive in 33 eyes. Fundus examination was positive for DR in 28 eyes, out of these 33 AG positive eyes. 30 eyes out of 51 AG negative were DR positive (Table 1). Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) were 48.3%, 80.8%, 84.8% & 41.2% respectively.

Group B (DM of 16-20 years duration) had 41 eyes. AG test was positive in 26 eyes, out of which 23 eyes were DR positive. DR was positive in 9 eyes out of 15 AG negative eyes. (Table 2) Sensitivity, specificity, PPV, NPV was 71.9%, 66.7%, 88.5% & 40% respectively.

Group C (DM of more than 20 years duration) comprised of 21 eyes. AG was positive in 14 eyes. All 14 eyes were DR positive. 6 eyes were DR positive out of remaining 7 AG negative eyes. (Table 3) Sensitivity,

specificity, PPV, NPV was 70%, 100%, 100% & 14.2% respectively.

Amsler grid test detects macular pathology. The association between diabetic macular edema (DME) and diabetic mellitus (DM) depends on the duration of the disease. Ten year disease duration is associated with a 5-10% incidence of DME, while 20 year disease duration has a 15-35% incidence of DME. Moreover recent studies highlights that DME is mostly seen in patients with a disease course of six years or longer, and its severity and incidence increases with prolonged period[12].

Group A i.e. eyes with DM since 10-15 years, comprised 84 eyes. Out of these, 58 eyes had Diabetic Retinopathy (DR) changes on fundus examination. Amsler grid test was able to detect 28 eyes and 30 eyes were missed. Group B i.e. eyes with DM for 16-20 years, comprised 41 eyes. Out of these, 32 eyes had DR changes. Amsler grid test was able to detect 23 eyes while just 9 eyes were missed. Group C i.e. eyes with DM for >20 years, contained 21 eyes. Out of these, 20 eyes had DR changes. Amsler grid was able to detect 14 eyes and just 6 eyes were missed. Thus the sensitivity of the test increases as the duration of DM increases.

In group A out of 84 total eyes, 26 eyes did not have DR changes. Amsler grid test was able to rule out 21 eyes, while 5 eyes were falsely detected positive. In group B out of total 41 eyes, 9 eyes did not have DR changes. Amsler grid test was able to rule out 6 eyes while only 3 eyes were falsely detected positive. Interestingly, in group C out of 21 eyes only 1 eye did not have DR and Amsler grid was able to screen it negative. Thus specificity increases with duration of diabetes. Hence Amsler grid test can be utilized as an effective screening modality for DR especially in patients with DM for 16years and above.

Table-1: Amsler grid test in group A (10-15 years of DM)

	DR +	DR -	
AG +	28	5	33
AG -	30	21	51
	58	26	84

AG+ :amsler grid test positive; AG- : amsler grid test negative; DR+ : diabetic retinopathy changes present; DR- : no diabetic retinopathy changes

Table 2: Amsler Grid Test In Group B (16-20 years of DM)

	DR +	DR -	
AG +	23	3	26
AG -	9	6	15
	32	9	41

AG+ :amsler grid test positive; AG- : amsler grid test negative; DR+ : diabetic retinopathy changes present; DR- : no diabetic retinopathy changes

Table 3: Amsler Grid Test In Group C (> 20 years of DM)

	DR +	DR -	
AG +	14	0	14
AG -	6	1	7
	20	1	21

AG+ :amsler grid test positive; AG- : amsler grid test negative; DR+ : diabetic retinopathy changes present; DR- : no diabetic retinopathy changes

Few cases showed a positive test despite having no DR changes in the fundus. These were the cases with age-related macular degeneration, branched retinal artery/ vein occlusion, epiretinal membrane, macular hole and other macular pathology. Thus apart from DR, Amlser Grid may also detect the above crucial cases in early stages.

Treatment of DR at early stages comprises of lasers or intra-vitreal anti-VEGF which are economical. Unfortunately, majority of the rural population presents to the tertiary centre at a very late stage of the disease like vitreous hemorrhage or retinal detachment. At this stage the visual prognosis is very poor and the resultant cost of the treatment in the form of vitreoretinal surgery is very high which is not affordable by most of the rural population. If DR can be detected at an early stage in this population, the visual prognosis will be much better and the cost of treatment will be drastically reduced. Regular screening and early treatment of DR/DME can potentially save years of vision with resultant reduction in treatment cost [13]. This practice can be initiated at a younger age as the CURES[6] also reported a temporal shift in the age at diagnosis of DM to a younger group when compared to the NUDS study [14].

So we recommend that if amsler grid chart can be printed in newspapers, magazines, pamphlets etc. so that common population can access it. The paramedical staff can also be trained to use the Amsler grid test which would bridge the ophthalmologists to population gap in rural India for screening of DR. Any metamorphopsia or scotoma can be reported easily and early, leading to timely diagnosis.

CONCLUSION

Although it does not have very good sensitivity for the early diabetic retinopathy changes but its sensitivity and specificity increases with duration of diabetes, as the incidence of macular involvement increases with the duration of diabetes. This can be utilized as an effective modality for increasing awareness [15] and empowerment [16] of the community as the common people can be taught to read Amsler grid by the paramedical staff in the PHCs or CHCs. Cases of DR and even other retinal pathology detected by paramedical staff or by self-screening can be referred to tertiary care centre at early stages with resultant early diagnosis, better prognosis and reduction in cost of treatment.

Our study strongly suggests that Amsler grid test is indeed a good screening modality. It is a simple cost effective test. It can be a boon for developing countries where costly screening tests and treatment of complications is a burning issue.

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