

Comparing the screening accuracy of CASA vision screener and the amsler grid in age-related macular degeneration.

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INTRODUCTION

Age-related macular degeneration (AMD) is one of the most important causes of blindness in patients older than 65 years old living in developed countries [1-3]. Projections estimate that its prevalence will nearly double (9.1 million to 17.8 million cases) in the United-States between 2010 and 2050 [4]. AMD is a disease affecting central vision by causing scarring, swelling and neovascularization of the macula. It can be classified as atrophic (or "dry") AMD, or as exudative (or "wet") AMD. Dry AMD is characterized by subretinal accumulations (drusen) and ischemia of the photoreceptors and retinal pigment epithelium (RPE). In response to ischemia, angiogenic factors may be released, causing choroidal neovascularization (CNV) and fluid accumulation (wet AMD). These patients may present with acute visual distortions (metamorphopsia) and demarcated areas of vision loss (scotoma). Screening, early diagnosis, and treatment for CNV are crucial in order to preserve as much vision as possible.

The most commonly used screening tool is the amsler grid. This is a non-invasive test that illustrates the metamorphopsia and scotoma experienced by patients. However, its utility has been questioned due to its low sensitivity and specificity [5], which may be explained by the cortical filling-in phenomena. In a study by Lowenstein *et al.* [6], validity of the amsler grid was stratified by CNV, geographic atrophy, high-risk characteristics (HRC) and non-HRC. They calculated sensitivities ranging from 16.67% to 34.38%, specificity of 98.04% across categories, PPV of 75.00% to 91.67%, and NPV of 60.98% to 76.92%. These validity measures were different in other studies. In particular, Do *et al* reported a 42% and 12% sensitivity and specificity, respectively, for the amsler grid [5].

Fluorescein angiography and optical coherence tomography (OCT) are key complementary diagnostic tests used in the diagnosis of CNV. Taking advantage of the concept that intra- and/or sub-retinal fluid (IRF, SRF) will modify the macular topography in wet AMD, a new screening test called the CASA vision screener was developed to detect chromatic aberrations in AMD. Considering green light is refracted to a greater extent compared to other colors (red light is the least refracted; yellow is intermediate), patients with thickened retina should see within the green spectrum better than in the red one. This is due to a hyperopic shift caused by the elevation of the photoreceptors by IRF/SRF.

The CASA vision screener is a modified Snellen-like chart with its background divided vertically in three colors: red, green and yellow. Using their usual reading glasses, patients are asked to read the letters on the chart and assess whether they are clearer in one of the three colors. As mentioned earlier, a better vision in the green spectrum would indicate a hyperopic shift (as in physiological hyperopia or in wet AMD). Moreover, better vision in the red spectrum signifies a myopic shift, which can commonly be due to either physiological myopia or cataract formation. Finally, better vision in the yellow spectrum would be indicative of astigmatism (myopic, hyperopic or mixed).

PURPOSE

To compare the accuracy of two non-invasive screening methods for AMD: namely the CASA vision screener and the amsler grid.

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METHODS

- 112 normal and 101 eyes with AMD (dry or wet) presenting to a single retina specialist between 2014 and 2015 were prospectively screened with both the CASA vision screener (left photo) and the amsler grid (right photo).



- All included patients had an OCT, which served as the goldstand pathological diagnosis.
- The outcomes of each tests (disease vs no disease) were compared using the Mann-Whitney U Test.
- The sensitivity and specificity as well as the positive and negative predictive values (PPV, NPV, respectively) of both screening tests were computed.

RESULTS

Descriptive Statistics

| Age (Years) | Sex | Pathology | | |
|-------------|----------------------|-------------|------------------|-----|
| | | Normal | AMD: 47% (n=101) | |
| | | | Dry | Wet |
| 78.7 ± 11.2 | Men 45% Woman 55% | 53% (n=112) | 49% | 51% |
| | | | IRF | SRF |
| | | | 39% | 61% |

Comparative Statistics

| | OCT | |
|--------|--------------------------|--------------------------|
| | IRF | SRF |
| AMSLER | Significant (p<0.05) | Significant (p<0.05) |
| CASA | Not significant (p>0.05) | Not significant (p>0.05) |

| | AMSLER | |
|------|----------------------|----------------------|
| | IRF | SRF |
| CASA | Significant (p<0.05) | Significant (p<0.05) |

RESULTS (continued)

Biostatistics: validity parameters

| AMSLER | Disease Present | Disease Not Present |
|----------|-----------------|---------------------|
| Test +ve | 40 | 82 |
| Test -ve | 11 | 80 |

| CASA | Disease Present | Disease Not Present |
|----------|-----------------|---------------------|
| Test +ve | 15 | 31 |
| Test -ve | 36 | 131 |

| | PPV | NPV |
|--------|------|------|
| AMSLER | 32.8 | 87.9 |
| CASA | 32.6 | 78.4 |

| | Sensitivity | Specificity |
|--------|-------------|-------------|
| AMSLER | 78.4 | 49.4 |
| CASA | 29.4 | 80.9 |

- With respect to retinal fluid (IRF and SRF):
 - Amsler grid is 2.5x more sensitive
 - CASA vision screener is 1.6x more specific

CONCLUSIONS

- This is first study to prospectively compare the screening accuracy of the CASA vision screener and amsler grid to OCT.
- Our data clearly show the usefulness of the CASA vision screener in ruling in a diagnosis of AMD.
- The CASA vision screener can be used by patients undergoing treatment for wAMD to gauge for disease remission.
- The amsler grid was found to be superior in ruling out AMD.
- Certainly, a larger patient cohort will be useful in further evaluating the validity of the CASA vision screener in retinal pathologies involving IRF and SRF.