**Early detection and management of Glaucoma**

**A new scoring system (update)**

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**Introduction**:

For early diagnosis of glaucoma or glaucoma suspect in absence of stigmata of one or more of the triad (IOP, field changes and Cupping) is very difficult, sometimes impossible and in most of the cases is controversial.

The risk factors for getting glaucoma include age, race, sex, heredity, family history, systemic (Diabetes, Obesity, Hypertension, Hypotension, arteriosclerosis and smoking) and socioeconomic factors as well as local factors (myopia, corneal thickness and scleral rigidity) all will channel into the resultant disc damage for the systemic and level of IOP for the local factors. So calculation of the combined probability of getting glaucoma for these 2 factors alone will include all the above mentioned variables. 3-11

For the calculation of the combined probability of getting glaucoma the study will analyze the probability of getting glaucoma in relation to IOP alone (X axis in table I) then the probability in relation to cup disc ratio (Y axis in table I). Also the combined probability for every X = IOP and every Y=C/D ratio.

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Figure 1 demonstrates the probability of getting glaucoma ($Y_1$) in relation to the IOP ($X_1$) and its derived equation:

$$Y_1 = Y_0 + A_1 e^{X/T_1}$$

$Y_1$ is the probability of the incidence of POAG in the next 5 years when the IOP = $x_1$ (modified from Davanger M, Ringvold A, Bilka S. The probability of having glaucoma at different IOP levels. Acta Ophthalmol. 1991;69:565-8).

Figure 2 demonstrates the probability of getting glaucoma ($Y_2$) in relation to the C/D ratio ($X_2$) and its derived equation:

$$Y_2 = Y_0 + A_1 e^{X/T}$$

$Y_2$ is the probability of the incidence of POAG in the next 5 years when the C/D ratio = $x_2$ (modified from Wensor MD, McCarty CA, Stanislavsky YL, Livingston PM, Taylor HR. The prevalence of glaucoma in the Melbourne Visual Impairment Project. Ophthalmology. 1998 Apr;105(4):733-9.)

The combined probability will take in consideration the IOP ($Y_1$) and the C/D ($Y_2$) ratio as the resultant outcome as shown in table 1:

$$\frac{Y_1 + Y_2}{2}$$
### Early Detection of Glaucoma

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<table>
<thead>
<tr>
<th>C/D ratio</th>
<th>Target IOP</th>
<th>Normal</th>
<th>Possible</th>
<th>Probable</th>
<th>Highly Probable</th>
<th>Definite</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1</td>
<td>18</td>
<td>12</td>
<td>14</td>
<td>15</td>
<td>15</td>
<td>13</td>
</tr>
<tr>
<td>0.2</td>
<td>17</td>
<td>17</td>
<td>16</td>
<td>15</td>
<td>14</td>
<td>13</td>
</tr>
<tr>
<td>0.3</td>
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<td>16</td>
<td>15</td>
<td>14</td>
<td>14</td>
<td>13</td>
</tr>
<tr>
<td>0.4</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>14</td>
<td>15</td>
<td>13</td>
</tr>
<tr>
<td>0.5</td>
<td>14</td>
<td>14</td>
<td>15</td>
<td>14</td>
<td>15</td>
<td>13</td>
</tr>
<tr>
<td>0.6</td>
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<td>13</td>
<td>15</td>
<td>14</td>
<td>15</td>
<td>13</td>
</tr>
<tr>
<td>0.7</td>
<td>12</td>
<td>12</td>
<td>15</td>
<td>14</td>
<td>15</td>
<td>13</td>
</tr>
<tr>
<td>0.8</td>
<td>11</td>
<td>11</td>
<td>15</td>
<td>14</td>
<td>15</td>
<td>13</td>
</tr>
<tr>
<td>0.9</td>
<td>10</td>
<td>10</td>
<td>15</td>
<td>14</td>
<td>15</td>
<td>13</td>
</tr>
</tbody>
</table>

**Table 1:** The combined probability of IOP with C/D ratio which predicts the probability of glaucoma in the next 5 years.
Early diagnosis

Accordingly people are classified after calculation of the probability of getting glaucoma into the following:

- **Normal** up to a probability of 0.10 on the probability scale with normal IOP 21 mmHg or less and C/D ratio up to 0.5: (Nothing to be done)
- **Ocular hypertension** in whom the rise of IOP above 21 mmHg is the only sign with normal C/D ratio and their management will follow the general scheme of possible, probable, or definite as will be demonstrated.
- **Possible** up to a probability of 0.20 on the probability scale with rise of IOP more than 21 mmHg and increase of C/D ratio but the combined probability will not exceed 0.22. (Observation)
- **Probable** up to a probability of 0.30 on the probability scale (these have to be treated and observed) a monotherapy may be sufficient to achieve the target IOP
- **Highly probable** up to a probability of 0.40 on the probability scale (treatment vigorously and observe) a bitherapy may be needed to achieve the target IOP
- **Definate** more than a probability of 0.40 on the probability scale (full tolerable treatment, laser or surgery and observe to achieve the target IOP)

Subject and methods:

The following are examples to demonstrate how to manage these problematical cases. **glaucoma suspect** Including ocular hypertension

<table>
<thead>
<tr>
<th>Case no.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
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</thead>
<tbody>
<tr>
<td>Sex</td>
<td>Male</td>
<td>Female</td>
<td>Male</td>
<td>Male</td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>Age</td>
<td>55</td>
<td>62</td>
<td>58</td>
<td>22</td>
<td>70</td>
<td>52</td>
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<tr>
<td>History</td>
<td>DM 5yrs +ve family history</td>
<td>Hypotension Hyperlipidemia Smoker</td>
<td>DM 5yrs +ve FH</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IOP</td>
<td>31</td>
<td>27</td>
<td>26</td>
<td>22</td>
<td>25</td>
<td>12</td>
</tr>
<tr>
<td>Fundus</td>
<td>0.3</td>
<td>0.4</td>
<td>0.1</td>
<td>0.6</td>
<td>0.5</td>
<td>0.7</td>
</tr>
<tr>
<td>Field</td>
<td>Normal</td>
<td>Normal</td>
<td>Normal</td>
<td>Normal</td>
<td>Normal</td>
<td>Normal</td>
</tr>
<tr>
<td>Corneal thickness</td>
<td>540</td>
<td>520</td>
<td>510</td>
<td>560</td>
<td>510</td>
<td>500</td>
</tr>
<tr>
<td>refraction</td>
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<td>-3.0</td>
<td>-</td>
<td>-6.0</td>
<td>-</td>
<td>-7.0</td>
</tr>
<tr>
<td>Probability Table 1</td>
<td>0.453</td>
<td>0.276</td>
<td>0.195</td>
<td>0.197</td>
<td>0.200</td>
<td>0.240</td>
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<tr>
<td>Target IOP Table 2</td>
<td>16</td>
<td>15</td>
<td>observe</td>
<td>observe</td>
<td>observe</td>
<td>10</td>
</tr>
</tbody>
</table>
**Target IOP**

In cases in whom treatment is necessary we have to achieve the target IOP. Our target IOP is to reduce the pressure to a probability of 0.11 or maximally 0.22 if it is possible taking in consideration that the IOP has to be corrected for any change in the corneal thickness or scleral rigidity and the cup disc ratio corrected for any notching or otherwise of manifestations of optic disc damage. (table 2)

<table>
<thead>
<tr>
<th>C/D ratio</th>
<th>0</th>
<th>0.1</th>
<th>0.2</th>
<th>0.3</th>
<th>0.4</th>
<th>0.5</th>
<th>0.6</th>
<th>0.7</th>
<th>0.8</th>
<th>0.9</th>
<th>1.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target IOP mmHg</td>
<td>20</td>
<td>18</td>
<td>17</td>
<td>16</td>
<td>15</td>
<td>14</td>
<td>13</td>
<td>11-12</td>
<td>10</td>
<td>9</td>
<td>8</td>
</tr>
</tbody>
</table>

Table 2: shows target IOP guided by the C/D ratio

Other methods of estimation of the target IOP are not included in this study and a separate study on the target IOP will deal with these estimations in detail.

**Management**

- **Normal**: nothing to be done
- **Possible**: observe
- **Probable**: treat and observe
- **Highly probable**: treatment vigorously & observe
- **Definite**: full tolerable treatment, laser or surgery & observe

**References:**


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• Dr Wesam Salah: lecturer of mathematics, NILES, Cairo Universirty
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