Clinical Area: Pachymetry for the diagnosis of glaucoma
Keywords: Primary open-angle glaucoma, normal tension glaucoma, ocular hypertension, corneal thickness

Study Type: Comparison of diagnostic tests
Study Aim: To compare the classification of patients as having ocular hypertension (OHT), primary open-angle glaucoma (POAG) and normal tension glaucoma (NTG) with and without the use of central corneal thickness (CNN) measurements.

Outcomes
- **Primary:** Central corneal thickness (CCT), patient diagnosis.

Design
- **Number of subjects:** n=133
- **Description of study population:** Patients recruited from the glaucoma department of an eye hospital in Switzerland from June 1997 to January 1998. Control subjects were also recruited (details not provided). Patients were 100% white; there were 64 women and 69 men. 22 were diagnosed with NTG; 49 with POAG; 44 with OHT and there were 18 controls.
- **Inclusion and exclusion criteria:** Included patients with glaucoma or ocular hypertension and normal controls. Patients were excluded if they had ocular disease other than glaucoma, myopia or hypermetropia >3 diopters (D) or an astigmatism of >1D.
- **Procedure:** Intraocular pressure was measured with a calibrated Goldmann applanation tomometer. The average of 3 consecutive readings without glaucoma medication was used. Central corneal thickness was measured with an ultrasonic pachymeter. Ten measurements of the central cornea were taken; the lowest CCT was used because it was believed to be the most accurate. Diagnosis was determined with and without correction of the IOP for central corneal thickness. A correction factor reported in the literature (Ehlers, 1975) was used. One randomly selected eye was used for analysis.

Validity
- **Independent blind comparison with a gold standard or follow-up of those not receiving the gold standard test?** The study was not designed to determine sensitivity and specificity of either test and did not use a gold standard. However, all measurements were made by an observer masked to the diagnosis.
- **Was "normal" defined?** Yes, normal was defined in terms of IOP and visual field changes.
- **Appropriate spectrum of disease?** Yes.
- **Consecutive patients?** Not specified.
- **Methods described in enough detail to enable you to replicate the test?** Yes.
- **Reproducible results?** Yes.

Conclusions regarding validity of methods:
The study design was valid for its stated purpose. It was not designed to evaluate the sensitivity and specificity of any test. The sample size was relatively small.
Results

Diagnoses:

Primary open-angle glaucoma (POAG): IOP ≥ 22 mg Hg in the presence of a typical glaucomatous disc and field changes, and an open angle on gonioscopy.

Normal tension glaucoma (NTG): IOP ≤ 21 mm Hg in the presence of a typical glaucomatous disc and field changes, and an open angle on gonioscopy.

Ocular hypertension (OHT): IOP ≥ 22 mg Hg with normal discs and visual fields and open angles on gonioscopy.

Central corneal thickness (CCT) and intraocular pressure (IOP) in the different groups of patients, mean ± SD

<table>
<thead>
<tr>
<th></th>
<th>Controls</th>
<th>NTG</th>
<th>OHT</th>
<th>POAG</th>
</tr>
</thead>
<tbody>
<tr>
<td>CCT, μm</td>
<td>552 ± 34</td>
<td>521 ± 31</td>
<td>583 ± 34</td>
<td>543 ± 35</td>
</tr>
<tr>
<td>IOP, mmHg</td>
<td>15.88 ± 2.82</td>
<td>17.25 ± 1.93</td>
<td>27.13 ± 3.84</td>
<td>23.33 ± 7.10</td>
</tr>
<tr>
<td>IOP, mm Hg corrected</td>
<td>--</td>
<td>19.45 ± 2.42</td>
<td>24.83 ± 2.53</td>
<td>23.97 ± 6.90</td>
</tr>
</tbody>
</table>

Reclassification of Patients correcting for CCT

7/22 (32%) of patients diagnosed with NTG had IOPs of ≥ 22 mg Hg (reclassified as POAG)

25/49 (51%) of patients initially diagnosed with OHT had IOPs of ≤ 21 mm Hg (reclassified as normal IOP)

Authors' Conclusions

"Patients with NTG have a thinner CCT than do patients with POAG or controls. Underestimation of the IOP in patients with POAG who have thin corneas may lead to a misdiagnosis of NTG, while overestimation of the IOP in normal subjects who have thick corneas may lead to a misdiagnosis of OHT".

Reviewer's Conclusions

Study findings suggest that central corneal thickness measured by ultrasonic pachymeter has an impact on diagnosis. Corneal thickness measurements caused the diagnosis to be changed to POAG for 7 out of 22 (32%) of patients classified as NTG and caused the diagnosis to be changed to normal IOP for 25 out of 49 (51%) of patients classified as IOP. The study sample was relatively small and findings may be unreliable. There was no gold standard and true diagnosis of patients was not known.