Effect of a tight necktie on intraocular pressure

C Teng, R Gurses-Ozden, J M Liebmann, C Tello, R Ritch

Aim: To evaluate the effect of a tight necktie on intraocular pressure (IOP) measurement using Goldmann applanation tonometry.

Methods: 40 eyes of 20 normal subjects and 20 open angle glaucoma patients (all male) were enrolled. IOP was measured with an open shirt collar, 3 minutes after placing a tight necktie, and 3 minutes after loosening it. All measurements were made by the same examiner.

Results: Mean IOP in normal subjects increased by 2.6 (SD 3.9) mm Hg (p=0.008, paired t test; range −3 to +14 mm Hg) and in glaucoma patients by 1.0 (1.8) mm Hg (p=0.02, paired t test; range −2 to +4.5 mm Hg). In normal subjects, IOP in 12 eyes was increased by ≥2 mm Hg and in seven eyes by ≥4 mm Hg. In glaucoma patients, IOP in six eyes was increased by ≥2 mm Hg and in two eyes by ≥4 mm Hg.

Conclusion: A tight necktie increases IOP in both normal subjects and glaucoma patients and could affect the diagnosis and management of glaucoma.

Elevated intraocular pressure (IOP) remains the most important known risk factor for the development and progression of glaucomatous damage. Accurate measurement of IOP remains crucial in decisions regarding management. Many patients wear tight neckties throughout the day and continue wearing them during IOP measurements. We hypothesised that this may elevate IOP by increasing episcleral venous pressure. During routine examination, if a patient were to be wearing a tight necktie, the increased IOP could lead to an erroneous diagnosis of ocular hypertension or even glaucoma.

Moreover, if the patient consistently were to wear a tight necktie as a normal preference in daily life, this could lead to a sustained increase in IOP and could predispose to the development of glaucomatous optic neuropathy, thereby rendering a tight necktie a risk factor as well as a confounder of accurate IOP measurement.

We evaluated the effect of tight neckties on IOP measurement by Goldmann applanation tonometry.

RESULTS

Twenty eyes of 20 normal subjects and 20 eyes of 20 open angle glaucoma patients were enrolled. Normal subjects were younger than the glaucoma patients (mean age 35.1 (SD 9.6) years (range 21–57 years) vs 62.2 (11.4) years (range 42–75 years), p<0.0001). Table 1 shows IOP before, during, and after necktie tightening. Mean IOP in normal subjects increased by 2.6 (3.9) mm Hg (p=0.008, paired t test) and in glaucoma patients by 1.0 (1.8) mm Hg (p=0.02) following tightening. After loosening the tie, mean IOP in normal subjects decreased by 3.3 (2.7) (p<0.0001) and in glaucoma patients by 1.3 (2.1) (p=0.02). There was no difference in IOP before necktie tightening and after loosening in both normal subjects and glaucoma patients (mean change +0.7 (2.1) mm Hg (p=0.16); and +0.25 (1.4) mm Hg (p=0.44), respectively).

The increase in IOP after tightening was not related to age (r²=0.08, p=0.23 for normal subjects; r²=0.007, p=0.73 for glaucoma patients). There was no difference in IOP elevation between glaucoma patients and normal subjects during necktie tightening (p=0.38, t test), nor in IOP decrease after necktie loosening (p=0.26). In normal subjects, IOP of 12 eyes increased by ≥2 mm Hg and in seven eyes by ≥4 mm Hg. In glaucoma patients, IOP of six eyes increased by ≥2 mm Hg, and in two eyes by ≥4 mm Hg. IOP changes by group, before, during and after necktie tightening, are shown in Table 2.
DISCUSSION

Accurate measurement of IOP is important for the detection and management of glaucoma. Numerous situations and factors that can lead to erroneous and inaccurate IOP readings include instrumental, anatomical, physiological, examiner induced and patient induced sources of error. \(^5\)\(^\text{-}^\text{10}\)

In an earlier study, inflation of a sphygmomanometer cuff around the neck to 40 mm Hg conferred a doubling of IOP. \(^1\) This demonstrated that an extremely tight constriction around the neck would cause an increase in IOP. In using a necktie instead of a blood pressure cuff, and having our patients subjectively determine their point of discomfort, we approximated a real life situation and demonstrated a common and often overlooked risk factor for increased IOP and a confounder for accurate IOP measurement. A tight necktie can be considered a risk factor in men who prefer to wear tight neckties, men with thick necks, and white collar professionals. In our study, although the mean IOP was not significantly increased after tightening the necktie, 70% of normal subjects and 60% of glaucoma patients experienced an increase in IOP and there were clinically significant results can be the subject of further investigation. Not all subjects experienced an increase in pressure after tightening, and some even had a decrease. This unexpected result might be attributable to anatomical variation and possibly a baroreceptor reflex. Normal deviation from the mean must also be taken into account.

In summary, a tight necktie may cause an increase in IOP in susceptible individuals and should be included among the confounders of accurate IOP measurement and considered as a risk factor for increased IOP.

ACKNOWLEDGEMENTS

Supported in part by the Ira and Shirl Oppenheimer Research Fund of the New York Glaucoma Research Institute, New York, NY, and New York Eye and Ear Infirmary Department of Ophthalmology Research Fund, New York, NY, USA.


The authors have no financial interest in any device or technique described in this paper.

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Table 1 Goldmann applanation tonometry mean IOP (SD) (range) measurements before, during necktie tightening, and after loosening the necktie

<table>
<thead>
<tr>
<th></th>
<th>Normal (n=20)</th>
<th>Glaucoma (n=20)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean IOP before tightening (mm Hg) (range)</td>
<td>15.3 (2.6) (10 to 20)</td>
<td>16.9 (3.8) (12.5 to 25)</td>
</tr>
<tr>
<td>Mean IOP during tightening (mm Hg) (range)</td>
<td>17.9 (3.9) (12 to 26)</td>
<td>17.9 (4.9) (12 to 29)</td>
</tr>
<tr>
<td>Mean IOP after loosening (mm Hg) (range)</td>
<td>14.6 (2.1) (9 to 3 to 18)</td>
<td>16.6 (4.2) (11 to 27.5)</td>
</tr>
<tr>
<td>Mean IOP difference (before and during tightening) (mm Hg) (range)</td>
<td>2.6 (3.9) (−3 to +14)</td>
<td>1.0 (1.8) (−2 to +4.5)</td>
</tr>
<tr>
<td>Mean IOP difference (during tightening and after loosening) (mm Hg) (range)</td>
<td>3.3 (2.7) (−10 to +0.50)</td>
<td>1.3 (2.1) (−8.5 to +1)</td>
</tr>
<tr>
<td>p Value (paired t/test)</td>
<td>0.008</td>
<td>0.02</td>
</tr>
</tbody>
</table>

Table 2 IOP changes before, during necktie tightening, and after loosening the necktie

<table>
<thead>
<tr>
<th></th>
<th>Decreased</th>
<th>Increased</th>
<th>No change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal (n=20)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before tightening to during tightening (mean IOP change, mm Hg)</td>
<td>4 (20%) (1.6)</td>
<td>14 (70%) (4.1)</td>
<td>2 (10%)</td>
</tr>
<tr>
<td>During tightening to after loosening (mean IOP change, mm Hg)</td>
<td>18 (90%) (3.7)</td>
<td>1 (5%) (0.5)</td>
<td>1 (5%)</td>
</tr>
<tr>
<td>Before tightening to after loosening (mean IOP change, mm Hg)</td>
<td>11 (55%) (2.3)</td>
<td>7 (35%) (1.6)</td>
<td>2 (10)</td>
</tr>
<tr>
<td>Glaucoma (n=20)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before tightening to during tightening (mean IOP change, mm Hg)</td>
<td>6 (30%) (0.9)</td>
<td>12 (60%) (2.1)</td>
<td>2 (10%)</td>
</tr>
<tr>
<td>During tightening to after loosening (mean IOP change, mm Hg)</td>
<td>12 (60%) (2.3)</td>
<td>4 (20%) (0.8)</td>
<td>4 (20%)</td>
</tr>
<tr>
<td>Before tightening to after loosening (mean IOP change, mm Hg)</td>
<td>10 (50%) (1.3)</td>
<td>7 (35%) (1.1)</td>
<td>3 (15%)</td>
</tr>
</tbody>
</table>

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*Br J Ophthalmol* 2003 87: 946-948
doi: 10.1136/bjo.87.8.946

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