

# Predictive value of tonometry with Tono-pen® XL in primary care

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## ABSTRACT

This is a descriptive study designed to assess the predictive value of intraocular pressure (IOP) measurement in GPs' offices in an urban healthcare site using Tono-pen® XL. A total of 2044 patients, aged  $\geq 40$  years, were enrolled by consecutive sampling from patients visiting the GP. Those participants who had IOP  $\geq 21$  mmHg were referred to the ophthalmologist. Of the 226 then tested, ocular hypertension was confirmed in 100 participants (4.89%, 95% CI [confidence interval] = 3.93 to 5.85%). Predictive value was 44.2%. These results suggest the validity of using Tono-pen XL in the GP's office to detect ocular hypertension.

### Keywords

glaucoma; intraocular hypertension; intraocular pressure; predictive pressure; primary health care.

## INTRODUCTION

Among the risk factors associated with glaucoma, the most important is ocular hypertension, which has a prevalence range between 1.6 and 15%,<sup>1-4</sup> and is the only modifiable risk factor. In recent years, certain events have led to an increased interest in the early detection of ocular hypertension, and studies have shown that drug treatment of ocular hypertension prevents evolution to glaucoma.<sup>5</sup> Tonometers with an acceptable concordance and validity, with regard to those used as reference tonometers (Goldmann), and which are easy to use and require minimal training have appeared on the market. These include the

Tono-pen® XL (Medtronic Solan, Florida, US), which has been well endorsed and has a low cost.<sup>6-7</sup>

The objective of this study was to calculate the predictive value of measuring intraocular pressure (IOP) in the GP's office using the Tono-pen XL.

## METHOD

A cross-sectional descriptive study was designed including 15 general practices in a city health centre and in its reference hospital in Leganés, Madrid. Patients aged  $\geq 40$  years presenting for any reason between 1 October 2000 and 31 May 2001 were included by consecutive sampling. Exclusion criteria were: known diagnosis of ocular hypertension or glaucoma, active conjunctivitis, or corneal condition. After patients signed consent forms, IOP was measured by one of the eight physicians who had already been given a training session in management of the tonometer.

The sample size obtained was 1520, overestimating up to 2000 participants to compensate for losses and non-responses.

IOP was measured with Tono-pen XL in both eyes following the administration of an anaesthetic collyrium. Patients with an IOP  $\geq 21$  mmHg in at least one eye were given an appointment with an ophthalmologist 1-3 weeks later for IOP measurement with the reference tonometer (Goldmann). Those with an IOP in both eyes  $< 21$  mmHg were regarded as normotensive, and those with IOP  $\geq 21$  mmHg were recalled for a further two measurements on different days; the average of the three was taken as the IOP value. Following revision of the data prior to the analysis, the frequency of ocular hypertension measured using the Tono-pen XL and the Goldmann tonometer and their 95% confidence intervals (CIs) were calculated.

## RESULTS

A total of 2044 patients were included in the study: 1297 females (63.5%), and 747 males (36.5%), with a mean age of 61.23 years (standard deviation [SD] 11.42 years).

An IOP value  $\geq 21$  mmHg was found in 247 patients (12.1%) referred to the ophthalmologist. However, 21

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## How this fits in

In recent years, tonometers with an acceptable concordance and validity, with regard to those used as a reference, and which are easy to use and require minimal training, have appeared on the market; these include the Tono-pen® XL. The predictive value obtained suggests that this may be useful in the early detection of ocular hypertension by GPs.

**Table 1. Health status of patients at time of interviews.**

Age, years	Patients, n	Ocular hypertension		
		n	%	95% CI
40–49	339	14	4.13	1.86 to 6.39
50–59	629	30	4.77	3.02 to 6.51
60–69	554	29	5.23	3.29 to 7.18
≥70	522	27	5.17	3.18 to 7.17
Total	2044	100	4.89	3.93 to 5.85

patients did not keep their appointment, so ophthalmologists' assessments were carried out in 226 patients (8.5%). Ocular hypertension was confirmed in 100 cases (44.2% of those referred from primary care).

The 100 patients in whom ocular hypertension was confirmed had a mean age of 61.84 years (SD 10.59) years, and 56% were women. There was no difference in age groups (Table 1).

### DISCUSSION

The predictive value of tonometry in this study (44%) is comparable to that in other studies.<sup>1,8,9</sup> Nevertheless, in view of the results obtained in Tono-pen XL validation tests, it is lower than expected.<sup>10</sup> The validity and reliability of the Tono-pen XL were analysed in an earlier phase of the study, with the first parameter presenting sensitivity versus the reference tonometer of 80.9% (95% CI = 76.51 to 85.39), and specificity of 89.2% (95% CI = 84.71 to 93.69) for IOP ≥21 mmHg. In terms of variability, an intraclass correlation of 0.87 (95% CI = 0.78 to 0.94) was found between ophthalmologists and GPs, and 0.76 (95% CI = 0.69 to 0.82) among four family doctors, only one of whom had had prior training.<sup>11</sup>

The disparity between the measurements taken by GPs and ophthalmologists is reflected in an overestimation of the IOP value by the GPs, and several reasons may account for this. First of all, in the prior validation studies, IOP was taken by the ophthalmologist and the GP consecutively, thus avoiding the known variability of IOP in the course of the day and on different days. In this study, however, the IOP was taken by the ophthalmologist several weeks later.

Another point to consider is that although interobserver variability between GPs is good, as shown by Salvador *et al*,<sup>11</sup> it was initially considered that a prior learning period was not necessary. However, after the work was completed, it was found that although Tono-pen XL is easy to use, a minimum learning process is desirable (shorter, in any event, than that of the conventional tonometer) before continuous use. Finally, IOP is only taken once in primary care, whereas the confirmation of ocular hypertension in ophthalmology required a triple take on different days. Fewer patients would probably have been referred if three tests had been performed on different days in primary care.

This is one of the studies with the greatest number of participants conducted in primary care<sup>1,8,12</sup> with a very low rate of losses in referrals to ophthalmology (8.5%). The predictive value obtained, together with the management ease of Tono-pen XL, suggest that this may be a useful tool for the early detection of ocular hypertension by GPs.

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### Ethics committee

Not applicable

### Competing interests

The authors have stated that there are none.

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