·Clinical Research·

Changes in intraocular pressure after topical anaesthetic instillation

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Abstract

• AIM: To determine the influence of topical anaesthetic drops, age and central corneal thickness (CCT) in the determination of intraocular pressure (IOP) by non contact tonometry (NCT).

• METHODS: Ninety-three eyes from 47 patients were examined for CCT and IOP by NCT before and after the instillation of topical anaesthetic drops.

• RESULTS: Average age was 66.4 (SD 16, range 34 to 88 years-of-age). Thirty one patients were female and 16 were male. Average basal IOP was 16.0mmHg (SD 4.0, range 8.5 to 26.1). IOP one minute after topical anesthesia instillation was 15.0mmHg (SD 3.8, range 7.7 to 26.7), and 14.9mmHg (SD 3.9, range 7.6 to 26.3) five minutes after the instillation. The differences were statistically significant for the 0 to 1 minute lapse(P=0.0007) and for the 0 to 5 minute lapse (P= 0.0003), but not for the 1 to 5 minute lapse (P=0.27) (Student's t test for paired data). Average CCT before topical anaesthetic drops was 565.4 microns. Simple linear regression analysis demonstrated absence of significant variation between age and IOP changes and between CCT and IOP changes.

• CONCLUSION: Our study confirms that the instillation of topical anaesthetics causes a reduction in IOP, which is progressive during the first 5 minutes after instillation. This IOP reduction does not seem to be associated with basal CCT or age.

• KEYWORDS: intraocular pressure; topical anaesthetics; age; non contact tonometry

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INTRODUCION

The determination of intraocular pressure (IOP) is among the usual procedures in everyday ophthalmic practice and is a central feature in the diagnosis and management of the glaucomas. However, the real determination of IOP can only be performed in laboratory conditions by cannulation of the anterior chamber. Clinical IOP determinations are usually performed by procedures (Goldmann and Perkins tonometry, non contact tonometry [NCT], tonopen, ocular blood flow tonograph) which depend on corneoscleral rigidity [1]. For this reason the mere value of IOP has lost importance in the study of normal pressure glaucoma and ocular hypertension in favor of IOP value corrected for corneal thickness. Central corneal thickness (CCT) is probably the most important factor influencing IOP determinations [2-12], with special relevancy due to the frequency of refractive procedures reducing corneal thickness such as Laser-Assisted *In Situ* Keratomileusis (LASIK) and photorefractive keratectomy (PRK), and the risk of underestimating high IOP in operated patients [13]. However, some other studies claim that this influence has been overestimated [13,14]. Other influencing factors such as lid squeezing, constrictive clothing, breathe holding and Valsalva maneuvers among others, should also be considered. The repetition of the measuring procedures usually tends to elucidate them[13].

During the past decade, Baudoin and Gastaud reported on the influence of anaesthetic drops to decrease IOP measured by air pulse NCT, finding a reduction in IOP determinations after the instillation of topical anaesthetics, which did not appear after the instillation of other topical drugs [15]. However, the influence of other parameters was not established.

In the present paper we present our results after measuring IOP prior and after topical anesthesia and investigate the influence of CCT and age in these changes.

MATERIALS AND METHODS

This is an observational study performed conforming to the provisions of the Declaration of Helsinki in 1995 (as revised in Edinburgh 2000). The patients' informed consent was obtained prior to performing the tests.

Ninety three eyes from 47 consecutive patients who were not receiving topical treatments were studied for CCT and IOP by non contact pneumotonometry. CCT was measured prior to IOP determination by a non contact pachymeter (Pachμmeter Haag Streit, Switzerland). IOP was determined (Full autotonometer Canon TX-F, USA) prior to, one and five minutes after the instillation of one drop of topical anesthesia (tetracaine chlorhydrate 1mg and oxibuprocaine chlorhydrate 4mg per 1mL)(Colircusi anestesico doble, Alcon-Cusi, Spain). Each of these determinations was repeated three consecutive times and the average value was used for calculation. The results were compared and the influence of CCT and age was analyzed using descriptive statistics and Student's *t* test for paired data.

RESULTS

Average age was 66.4 (SD 16, range 34 to 88 years-of-age). Thirty one were female and 16 were male.

Basal IOP was 16.0mmHg (SD 4.0, range 8.5 to 26.1). IOP pressure one minute after topical anesthesia instillation was 15.0mmHg (SD 3.8, range 7.7 to 26.7), and five minutes after the instillation was 14.9mmHg (SD 3.9, range 7.6 to 26.3). The differences were statistically significant for the 0 to 1 minute lapse (P=0.0007) and for the 0 to 5 minute lapse (P=0.0003), but not for the 1 to 5 minute lapse (P=0.27) (Student's *t* test for paired data).

Average corneal thickness was 565.4 microns (SD 23.9, range 509 to 603). IOP changes were statistically significant for corneal thicknesses below and over 560 microns for all the time lapses (corneal thickness ≤560 microns: 0-1 minute lapse, P= 0.0002; 0-5 minute lapse, P=0.0006; 1-5 minute lapse, P=0.01; corneal thickness > 560 microns: 0-1 minute lapse, P= 0.004; 0-5 minute lapse, P=0.06; 1-5 minute lapse, P=0.0007).

In the group of patients under 65 years-of-age (n=18), IOP changes were significant for the lapse 0 to 1 minute (P= 0.002), 0 to 5 minute (0.03) but not for the 1 to 5 minute lapse (P=0.46). For the group of patients older than 65 years-of-age (n=29), IOP changes were significant for the lapse 0 to 1 minute (P=0.009), 0 to 5 minute (P=0.006) and the 1 to 5 minute lapse (P=0.03).

A simple linear regression analysis was performed to investigate the association between age and IOP changes and between CCT and IOP changes. No significant variation was found between IOP and age or CCT (Pearson correlation coefficient r = 0.11 and r =-0.08 respectively for IOP changes for the lapse 0 to 1 minute; r =0.27 and r =-0.10 respectively for the lapse 0 to 5 minute; and r =0.20 and r =-0.03 respectively for the lapse 1 to 5 minute).

DISCUSSION

Determination of IOP in clinical practice must face procedure errors of several different origins, mainly but not only, corneal biomechanics, thickness and curvature[3,16]. Air pulse NCT is a safe and reproducible way to measure IOP. Some of its advantages are being reproducible and non dependant of the operator [17], avoiding the use of topical anaesthesia and fluorescein drops, thus reducing the risk of infections, and providing multiple IOP determinations reducing measurement errors[18]. CCT has been described to affect IOP determination, especially after corneal refractive surgery [19]. However this influence is more remarkable for NCT. Ko *et al* found that even though CCT influenced IOP determinations by using Goldman tonometer , NCT, and ocular blood flow tonometer; NCT was the most affected determination[20].

Baudouin *et al* demonstrated the effect of topical drugs on IOP determinations measured by NCT. They found out that IOP determination was affected by anaesthetic drops during the first minute after instillation. However, IOP was not affected by the instillation of indomethacin suspension. The authors also tried metipranolol finding out that this beta blocker did reduce IOP but this decrease was only significant for 15 minutes after installation, which was probably caused by the pharmacological effect of beta blockers by reducing aqueous production. The effect of IOP reduction after topical anaesthetic drops instillation can only be demonstrated by NCT, since this is the only procedure that does not require the use of anaesthetic drops.

The mechanism of IOP reduction may be attributed to a reduced lid squeezing or breathe holding of the patient preparing for the procedure. However, topical anaesthetic only reduces corneal and conjunctival sensitivity, and the patient will still be prepared for the air puff and will feel it on his or her lids and lashes. However, this mechanism might explain in part the fact that in our series the differences in IOP were more remarkable and statistically significant for the first minute after instillation (lapse 0 to 1 minute and 0 to 5 minutes), and the reduction was less

noticeable for the following minutes, once the anaesthetic effect is established (lapse 1 to 5 minutes).Other possible mechanisms such as the mechanical effects of repetitive IOP measurements or massage by eyelids secondary to corneal irritation by eye drops do not explain this reduction either, since IOP reduction should also appear on eyes treated with anaesthetic and non anaesthetic drops[15].

Topical anaesthetic drops (oxybuprocaine) have been found to reduce corneal thickness with variations higher than 10 microns three minutes after the instillation in 10 to 30% of the eyes according to Asensio *et al* [2].The effect of corneal thickness on IOP determination has been previously demonstrated in several papers [2-12]. Recept *et al* [12] have reported a higher variability in IOP determinations with increasing corneal thickness. In our series the changes induced by topical anaesthetics were significant for both groups of corneas, with more and less than 560 microns CCT, though the results were more significant for those under 560 microns.Corneal and conjunctival sensitivity are known to decrease with age [21]. Based on a merely anaesthetic effect of the drops in decreasing IOP determination, this effect should be less noticeable among elderly patients. However, in our series we have not found statistically significant changes in IOP after the drops for the group of age over and under 65 years of age.

The effect of topical anaesthetic drops to decrease IOP determination by NCT is a well demonstrated fact, though not easily explained. This effect adds to other known factors influencing IOP determination by NCT, and probably also affects IOP determination by contact procedures. Further studies on corneal thickness, curvature and sensitivity as well as underlying ocular conditions are needed to ascertain the influence of topical anaesthetics on IOP.

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