

Effect of different eye speculums on Intra Ocular Pressure

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Abstract

Objective: To measure the difference in intraocular pressure with use of two different types of eye speculums.

Methods: The study was conducted at the Department of Ophthalmology, Abbasi Shaheed Hospital, Karachi, from November 2011 to May 2012. Through probability convenience sampling, hundred patients were selected and divided into two equal groups. Complete history and ocular examination was done. Intraocular pressure was measured using Goldmann Applanation tonometer on slit lamp. It was again measured with Barraquer wire speculum inserted in the eyes of 50 patients, and Universal eye speculum in the other 50 patients with the help of Goldmann Applanation. SPSS 16 was used for statistical analysis.

Results: There were 63 (65%) males and 34 (35%) females with an overall mean age of 45 ± 14.09 years. The mean age baseline intraocular pressure of the right eye without speculum was 15.04 ± 3.83 mmHg and that of the left eye was 15.48 ± 4.00 mmHg. With Barraquer wire speculum, the value for the right eye was 22.21 ± 4.99 , and that of the left eye was 23.08 ± 5.41 . With Universal eye speculum, the value for the right eye was 25.51 ± 3.02 , and for the left eye it was 25.78 ± 3.64 . There was a statistically significant difference in baseline and post-speculum measurements ($p < 0.0001$). Paired sample t-test was also conducted for values of the two speculums and the result was statistically significant ($p < 0.0001$).

Conclusion: Barraquer wire speculum caused less increase in intraocular pressure compared to the Universal eye speculum. It should be preferred for intraocular surgeries to avoid increase in pressure during surgery and prolapse of ocular contents. Not only the effect of speculum, but also the type of speculum should be kept in mind when measuring intraocular pressure during examination under anaesthesia.

Keywords: Barraquer wire speculum, Universal eye speculum, Intraocular pressure. (JPMA 63: 1278; 2013)

Introduction

Intraocular pressure (IOP) is a type of chronobiological rhythm just like other physiological values in the human body, such as body temperature, heart rate, blood pressure and hormone secretion.¹ The tissue pressure of the intraocular contents is called the IOP. The normal range of IOP is 10-20 mm Hg and is maintained throughout life, in both males and females, with some diurnal and seasonal variations. Control of IOP within the correct physiological range is necessary for the anatomical conditions required for optimal refraction and thus vision.² Contraction of the extraocular muscles leads to an increase in IOP. This is evidenced by the increase in IOP observed when eye movement is opposed by traction by the surgeon. Normal blinking of human eye increases IOP by 10mmHg and forceful contraction of the orbicularis oculi can increase IOP to >50 mmHg.³ Coughing, straining, and vomiting can lead to an increase in IOP of 30-40mmHg. Laryngoscopy and intubation during general anaesthesia lead to a rise of 10-20mmHg

and this may be prevented by avoiding the hypertensive response to intubation and extubation.⁴ Valsalva manoeuvre has been associated with increase in IOP due to elevated venous pressure and increased tone of orbicularis oculi.⁵ Only one study has been found on the effect of a speculum on IOP in children under general anaesthesia.⁶ As such, the current study is the first of its kind as it aimed at measuring the difference in IOP by using two different types of eye speculums.

Patients and Methods

The cross-sectional comparative study was conducted at the Department of Ophthalmology, Abbasi Shaheed Hospital, Karachi, from November 2011 to May 2012. Patients were selected on the basis of non-probability convenient sampling from the outpatient department of the hospital. The sample size was determined by using the WHO software;⁷ $\alpha=5\%$, $1-\beta=90$, test value of population mean $\mu_0=20$, $\mu_a=14$, $n=96$. The study recruited 100 patients to avoid the chances of type 2 error.

It included both genders, ages between 18 to 60 years, with no active inflammatory or an infective eye disease, not using any topical medications, no history of previous ocular surgery and cooperative in nature. Patients with

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history of glaucoma, posterior segment pathology, only eye and with corneal opacities were excluded from the study. The patients selected were divided into two groups.

Detailed history of every patient was recorded. Their visual acuity was recorded and eye was examined on slit lamp. IOP was measured with Goldmann Applanation tonometer in both the groups. Before measuring IOP topical anaesthesia was instilled and then fluorescein in strip form. IOP was measured first in the right eye and then in the left. The measuring drum was turned until the inner borders of the fluorescein rings (adjusted for equal size) just touched each other at the midpoint of the ocular pulse and the overlap and separation of the mires with each pulse swing was equidistant from the midpoint on both sides. The measuring drum was then observed until this defined point was reached. After each reading, the tonometer was removed from the contact, the measuring scale was returned to 10mmHg and the head of the tonometer was sterilised. IOP was again measured with Barraquer wire eye speculum inserted in the eye in group 1, and with Universal eye speculum in group 2. All measurements were done by a single observer. Both the measurements were recorded and compared.

Data was entered and analysed on SPSS 16. Continuous variables of age and IOP were presented as mean \pm standard deviation. Categorical variable of gender was presented as frequency and percentage. Paired Sample t-test was used to compare the variable of baseline IOP with Barraquer speculum and Universal eye speculum.

Results

There were 63 (65%) males and 34 (35%) females with an overall mean age of 45 ± 14.09 years. The mean age baseline intraocular pressure of the right eye without speculum was 15.04 ± 3.83 mmHg and that of the left eye was 15.48 ± 4.00 mmHg. With Barraquer wire speculum, the value for the right eye was 22.21 ± 4.99 , and that of the left

Table-1: Descriptive statistics.

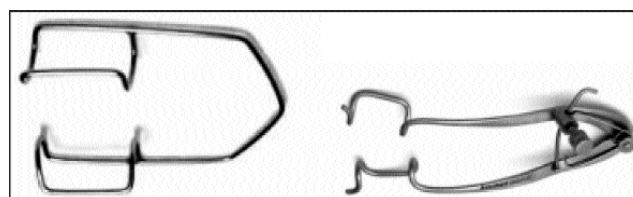
Gender	Frequency (%), N=100	
Male	(65)	65%
Female	(35)	35%
IOP (mm of Hg)	Mean, N=100	SD
Right Eye Base line IOP	15.04	3.83
Left Eye Base line IOP	15.48	4.00
Right Eye Barraquer Wire Speculum	22.21	4.99
Left Eye Barraquer Wire Speculum	23.08	5.41
Right Eye Universal Eye Speculum	25.51	3.02
Left Eye Universal Eye Speculum	25.78	3.64

IOP: intraocular pressure.

Table-2: Comparison of Baseline IOP with Barraquer and Universal Speculum IOP.

Variables	Right Eye Mean IOP \pm SD mm of Hg	Left Eye Mean IOP \pm SD mm of Hg	p-value (Paired Sample t-test)
Base line IOP	15.04 \pm 3.83	15.48 \pm 4.00	0.0001
IOP Barraquer Spec.	22.21 \pm 4.99	23.08 \pm 5.41	
Base line IOP	15.24 \pm 2.91	15.47 \pm 3.24	0.0001
IOP Universal Spec.	25.51 \pm 3.02	25.78 \pm 13.30	

IOP: intraocular pressure.



Barraquer eye speculum and universal eye speculum.

eye was 23.08 ± 5.41 . With Universal eye speculum, the value for the right eye was 25.51 ± 3.02 , and for the left eye it was 25.78 ± 3.64 . There was a statistically significant difference in baseline and post-speculum measurements ($p < 0.0001$) (Table-1).

Paired sample t-test was also conducted for values of the two speculums and the results was statistically significant ($p < 0.0001$) (Table-2).

Discussion

In ophthalmic intraocular surgeries such as cataract surgery, including phaco emulsification, extracapsular cataract extraction with or without intraocular lens implantation, small incisional cataract surgery, trabeculectomy and vitrectomy, it is important to prevent any rise in IOP before a surgical incision is made. As soon as the sclera is incised surgically, IOP equates to atmospheric pressure.⁷ An acutely raised IOP may cause expulsion of the intraocular contents, namely the iris, lens, vitreous and retina through a surgical or traumatic opening.^{2,8,9} There is also a possibility of retinal artery occlusion and retinal ischaemia.²

Sudden decompression of a hypertensive eye also increases the likelihood of rupture of a sclerotic short posterior ciliary artery in the choroid, producing an expulsive haemorrhage in the eye.⁹

The introduction of several millilitres of local anaesthetics into the orbit may lead to a rise in IOP. In fact, a rise in IOP has been demonstrated following peribulbar anaesthesia.¹⁰

An inadequate block would result in a rise in IOP during surgery. This is because of squeezing of the eye due to contraction of the orbicularis oculi muscle. Supplementation of the block with a facial nerve block (e.g. van Lint block) or infiltration into the eyelid would help in preventing this. Lid retractors may press the eye and cause bulging of the intraocular contents.¹¹ To reduce this extraocular pressure effect, loosening the speculum and eyelid sutures would help.

Pneumatonometer of Langham was used in one study¹² to record the effect of eyelid specula, lid sutures, and eyelid clamps on IOP. It was concluded that the degree of rise of IOP was related to the degree to which the eyelids were separated and all methods tested produced a rise in IOP in most patients. The study, therefore, recommended that a method of eyelid retraction which allows adjustment is to be preferred, and that specula which do not allow this, such as the Barraquer speculum, are not to be recommended.¹² But the current study found that the Barraquer speculum caused approximately 7mmHg increase in IOP compared to the Universal speculum which resulted in around 10mmHg. An earlier study⁶ showed an increase in IOP of 4mmHg after using an eye speculum in children under anaesthesia.

This difference may be related to the weight of a speculum as the Barraquer speculum is light in weight, and age of the patients and the sitting posture. Overweight patients may have an artificially elevated IOP because they strain to reach Goldmann Applanation tonometer. This can be overcome by using Perkin's hand-held tonometer.⁵ Traction upon the superior rectus suture also leads to a considerable rise in IOP and this should be avoided unless strictly necessary.¹² The traction produced by two limbal sutures pulling tangentially downwards,

rotates the eye downwards for intraocular surgery without inducing a rise in IOP.¹²

Conclusion

Barraquer wire speculum should be preferred over Universal eye speculum for intraocular surgeries to avoid increase in IOP during surgery and prolapse of ocular contents. The type of speculum and effect on IOP should be kept in mind when measuring IOP during examination under anaesthesia.

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