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Intra-ocular pressure correlation with isotonic exercise in Medical Students

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ABSTRACT

AIM: The aim of the study is to find the effect of Isotonic exercise (walking on treadmill) on Intraocular pressure. To find the association of exercise on intraocular pressure.MATERIALS AND METHODS: It is a prospective study conducted in the department of ophthalmology Meenakshi Medical College and research institute, Enathur, Kanchipuram from June 2019 – December 2019. Medical students satisfying inclusion criteria are selected, procedure were explained, consent for the study were taken.RESULT:In our study we noticed significant reduction in intraocular pressure measured immediately after an isotonic exercise (walking in treadmill for 30 minutes) in all students. CONCLUSION: our study showed a significant reduction in IOP and glaucoma is the second leading cause for blindness. So by this study we stress the importance of including exercise as an adjunct to anti-glaucoma agents for treating glaucoma.

Introduction

Aims and objectives: The aim of the study is to find the effect of Isotonic exercise (walking on treadmill) on Intraocular pressure. To find the association of exercise on intraocular pressure.

Materials and methods

This prospective study conducted in the department of Ophthalmology, Meenakshi Medical College and Research Institute, Enathur, Kanchipuram from June 2019 – December 2019 on fifty medical students, aged 18-25 years. After taking the approval from competent authority the study was started. The study involved measuring the intraocular pressure using the Goldmannapplanation tonometer in fifty medical students aged 18 to 25 years. Consent from all the participants were taken. No conflict of interest was there. After explaining the procedures which starts by the application of topical anaesthetic (Paracaine 0.5% ophthalmic solution) eye drops and instillation of fluorescein dye using fluorescein impregnated strips. Pre-exercise intraocular pressure was measured using Goldmannapplanation tonometer. Then the subject is asked to walk on the treadmill for 30 minutes with the speed of 5 km/hour. After exercise the subject's post-exercise intraocular pressure is measured using the same method.

INCLUSION CRITERIA

Medical students in the age group of 18-25 years

EXCLUSION CRITERIA

1. Any history of systemic diseases, smoking, ocular diseases [glaucoma etc],

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2. use of any systemic or local medications,
3. people who have undergone eye surgery within last three months were excluded,
4. Subjects with cardiac diseases, respiratory diseases & physical deformity in legs were excluded

FUNCTIONS OF AQUEOUS HUMOUR:

a) The shape and internal structure of eye is maintained is maintained by intraocular pressure. The maintenance of the intra-ocular pressure is the important function of aqueous humour.

b) METABOLIC FUNCTION: Addition of substrates and removal of metabolites from the avascular ocular structures is done by aqueous.

c) OPTICAL FUNCTIONS: Maintaining the optically clear anterior chamber and posterior chamber is done by aqueous humour by clearing the blood cells, lens matter, macrophages, products of inflammation.

Normally the aqueous is optically clear and it maintains the diverging lens of low power function by corneal aqueous interface.

INTRAOCULARPRESSURE:
The intra-ocular pressure is the maintained in its normal range by a dynamic equilibrium between aqueous humour formation, aqueous humour outflow and episcleral venous pressure.

The normal range of IOP is 15.5±2.5 mm of Hg.innumerable factors has an effect on the intraocular pressure. Examples: smoking, drugs , sex, age, ethnicity, neuronal control, genes, dietary exposures diurnal and postural variation, exertion, eyelid movements, intraocular conditions like uveitis., etc, systemic conditions like hypertension, diabetes, obesity, HIV etc.

FACTORS AFFECTING THE COMPOSITION OF AQUEOUS HUMOUR:

A) Blood ocular barrier, B) Hemodynamic factors, C) Diffusion, D) Metabolites, E) Rate of aqueous drainage, F) Neurohormonal factors.The temperature gradient of the anterior chamber causes a thermal current which in turn regulates the aqueous humour outflow.the 2 types of outflow system. They are: 1) Uveoscleraloutflow 2) Trabecular outflow

UVEOSCLERAL OUTFLOW:

It is responsible for 10-25% of total aqueous outflow. It drains approximately 0.3 microlit/minute which is independent of intraocular pressure.

TRABECULAR OUTFLOW:

75-90 % of the total aqueous outflow is drained via this route which forms main outlet of aqueous humour. Aqueous freely flows till juxtacanalicular meshwork which appears to provide mild resistance to the outflow.

Mechanism of IOP reduction following exercise:

Dynamic exercise results in increased metabolic activity which leads to increased level of lactate in blood and fluid efflux from plasma to skeletal muscle interstitium. Increase in blood

lactate and fluid efflux results in decrease in intraocular pressure. Increase in lactate level in blood and decrease in pH level of the blood causes direct effect in reduction of intraocular pressure and fluid efflux from plasma to skeletal muscle interstitium reduces IOP by causing increase in plasma colloidal pressure which further results in dehydration and reduction of vitreous volume, decrease ciliary body filtration forces and direct effect of hypothalamic action causes decrease in intraocular pressure.

TONOMETRY:

Intraocular pressure is measured by a technique known as tonometry.

There are 2 types of tonometer.

They are:

1) Indentation tonometry

2) Applanation tonometry

CLINICAL FEATURES of increased intraocular pressure:

SYMPTOMS:

1) Asymptomatic

2) Mild head ache, eye ache

3) Defect in visual field which may be subjective

4) Presbyopic glasses changed frequently due to consistent pressure over the ciliary muscle

5) Delayed dark adaptation

SIGNS:

1) Anterior segment:

i) Early stages – normal

ii) Late stages – sluggish papillary reflex, haziness of cornea.

2) IOP changes:

3) Optic Disc changes: Fundus examination is mandatory to observe optic disc changes in POAG.

i) Early changes:

a) Optic cup becomes vertical oval

b) Asymmetric optic cup between two eyes> 0.2

c) Large cup

d) Splinter haemorrhages on the margin of optic disc

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e) Retinal nerve fibre defect.

ii) Advanced changes:

a) Marked cupping

b) Neuroretinal rim thinning

c) Bayonetting sign

d) Pulsation of retinal arterioles

e) Lamellar dot sign

iii) Glaucomatous Optic atrophy: Optic nerve head gets deeply excavated, appears white due to the loss of nerve tissue.

4) VISUAL FIELD DEFECTS: It starts in the Bjerrum's area (10-25 degree of fixation), it can cause barring of blind spot and finally leads to tubular vision as the disease progresses.

INVESTIGATIONS:

1) Tonometry(applanation and Schiotz tonometer)

2) Diurnal variation test

3) Gonioscopy

4) Documentation of optic disc changes

Limitation of the study: The samples should have included the glaucoma patients. The intraocular pressure was not measured in a serial interval after the acute fall due to exercise to assess the return of intraocular pressure to the normal baseline. Additional parameters such as axial length of the eye ball, pulsatile ocular blood flow, serum osmolarity and blood pH were not measured.

Table 1: IOP differences pre and post exercise in right eye in males

S.no	Values	Right eye IOP (in mm of Hg)	
		Pre exercise	Post exercise
1	Minimum	8	8
2	Maximum	18	16
3	Mean	14.43	11.13
4	Standard deviation	2.5	1.92

Table 2: IOP differences pre and post exercise in left eye in males

S.no	Values	Left eye IOP (in mm of Hg)

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		Pre exercise	Post exercise
1	Minimum	10	8
2	Maximum	18	14
3	Mean	14.48	11.00
4	Standard deviation	2.61	1.73

Table 3: IOP differences pre and post exercise in right eye in females

S.no	Values	Right eye IOP (in mm of Hg)	
		Pre-exercise	Post-exercise
1	Minimum	8	8
2	Maximum	18	16
3	Mean	14.12	10.91
4	Standard deviation	2.56	1.74

Table 4: IOP differences pre and post exercise in left eye in females

S.no	Values	Left eye IOP (in mm of Hg)	
		Pre-exercise	Post-exercise
1	Minimum	10	8
2	Maximum	18	14
3	Mean	14.10	10.73
4	Standard deviation	2.57	1.72

DISCUSSION

Glaucoma, a chronic progressive optic neuropathy which results in progressive retinal ganglion cell death resulting in characteristic morphological changes at the optic nerve head and in retinal nerve fiber layer which causes visual field loss. A worldwide cause for irreversible blindness and the successor of cataract for bilateral blindness.

Aqueous humour dynamics is important for intraocular pressure maintenance and development of glaucoma. The forward continuation of choroid at oraserrata is pars plicata, the non-pigmented portion of the ciliary body secrets Aqueous humour.

Aqueous humour flows from ciliary body → into posterior chamber → through pupil → into the anterior chamber → angle of the anterior chamber , finally → into the aqueous outflow system.

With the aim of evaluating the effect of exercise on the intraocular pressure, we started this study with the study group comprising fifty students which included 35 males and 15 females. After consent from the students the methodology was framed out. The methodology included the application of the anaesthetic (Paracaine 0.5% ophthalmic solution) eye drops and fluorescein dyein both eyes followed by which the intraocular pressure was measured by Goldmannapplanation tonometer before and after exercising in the treadmill for about 30 minutes with the speed of 5 km/hour. The observation and results of the study were that the mean intraocular pressure decrease in right eye of the males and females, left eye of males and females were 3.21 and 3.54 mm of Hg, 3.33 and 3.85 mm of Hg respectively, the total (males and females) fall in mean IOP of right eye and left eye was 3.30 and 3.48 mm of Hg respectively. This decrease was found to be statistically significant($p<0.05$).

CONCLUSION

Thus from the above study we are concluding that there is a significant decrease in intraocular pressure after exercising for about 30 minutes in treadmill with the speed of 5 km/hr. Glaucoma is the second leading cause for blindness in the world and is also considered as the silent thief of sight. So by this study we stress the importance of exercise in controlling the glaucoma with the future aspect of adding the exercise as an adjunct to antiglaucoma drugs in the treatment of glaucoma.

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Conflicts of interest: nil

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