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Intraocular Pressure Changes and Anterior Chamber Angle Findings in Wind Instrument Players

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ABSTRACT

Aim: To evaluate the effect of playing wind instruments on the eye
Methods: In a prospective nonrandomized clinical trial, 22 age-matched male members of the band were compared to controls. The IOP was measured with rebound tonometer before playing instrument, during playing one musical piece and 10 minutes after they had stopped playing the instrument. The measurements were repeated after two months.
Results: Average difference between before IOP and during play IOP in right and left eye was 3.6 and 3.7 respectively (p value <0.001). Multiple clumps of pigment were found in the angles in 72% of wind instrument players. Controls were found to have one pigment clump in 2 out of 22 individuals (9%) only.
Conclusion: This study shows significant increase in intraocular pressure in wind instrument players in comparison to controls.

KEYWORDS: Glaucoma, intraocular pressure, wind instruments, pigments in angle

Introduction

Wind instrument players use valsalva maneuver when playing their instruments. It may cause many systemic complications such as cerebral haemorrhage, subarachnoid haemorrhage, stroke, aortic dissection, carotid artery dissection, epidural hematoma, spontaneous pneumothorax, esophageal varices and hiatus hernia. Known ocular complications of this maneuver are subconjunctival, retinal and foveal hemorrhages and retinal detachment[1] This maneuver is performed during coughing[2], lifting of heavy weights, straining during defecation or micturition, gagging, vomiting, blowing a stuffy nose, using the arm or upper trunk muscles to move up in bed and also while playing musical instruments. It is performed by moderately forceful attempted exhalation against a closed glottis which increases intraocular pressure (IOP) significantly by increasing intrathoracic pressure, which in turn, decreases venous return to the heart and increases central venous pressure. This increased central venous pressure by means of the jugular, orbital and vortex veins communicates with the choroid, raising the IOP by increasing pressure of the episcleral system thus interfering with the aqueous outflow and also increasing the volume of the choroidal veins. [3, 4, 5]

Wind instrument players use valsalva maneuver more often than normal population and for longer duration of time. Hence they may be at risk of developing ocular complications. On literature search, there was no study which has looked for ocular differences among wind instrument players in India.

Hence the study was conducted to examine the IOP changes that occurred during playing wind instruments and determine any differences in ocular findings between wind instrument players and controls.

MATERIALS AND METHOD

Members of professional musical band playing a variety of high resistance wind instrument were enrolled in the study. The inclusion criteria consists of males between 20-45 years of age, had played the wind instrument for more than 500 hours during lifetime, not suffering from cardiac diseases or diabetes mellitus, not on any systemic drugs or antiglaucoma drugs had no history of ocular trauma or was suffering from or had suffered from ocular disease.

Sample size was calculated based on following assumptions increase in IOP by 1.5 mm of Hg during performance with standard deviation of 2, taking alpha level at 5% and power at 80%. The calculated sample size was 16. However final sample size taken was 22 giving more than 90% (91.8%) power to the study.

A total of 22 age matched male members of the band but not playing wind resistance instruments, not suffering from cardiac diseases or diabetes mellitus, not on any systemic drugs or antiglaucoma drugs, had no history of ocular trauma or suffering from or had suffered from ocular disease ,were taken as controls.

Comprehensive ocular examination consisting of visual acuity, slit lamp examination of anterior segments, gonioscopy, pachymetry, optic nerve head evaluation, intraocular pressure measurement by NCT and visual field examination by Humphrey's visual field analyzer using the SITA standard algorithm, was done for personnel playing the high resistance wind instruments and controls.

The IOP during the experiment was measured using hand held, anesthetic free Rebound tonometer (iCare, Tiolat, Helsinki, Finland). This was used because IOP could be measured while the person was in an upright position and even while playing the instrument, its usage did not require an anaesthetic and it was simple to use .The tonometer has a small single use disposable probe of 0.9 mm radius which is held in position by an electromagnetic field. The probe collides with the central cornea while the instrument is aligned 4 to 8 mm from the patient's eye. The movement of the probe induces a small induction current, allowing the impact duration to be measured.

Measurements are taken within 0.1 seconds. The force applied is so minimal that it does not even elicit a blink reflex. Six consecutive readings are taken to minimize deviation and to produce an averaged measurement value.

Baseline IOP was measured before playing instrument, IOP was repeated while they were playing one musical piece lasting 5 minutes and then IOP was repeated 10 minutes after they had stopped playing the instrument. History was asked about the duration of instrument played in lifetime.

The measurements were repeated after two months and the averages of the two measurements were taken. All the measurements were done by the same ophthalmologist. The participants were followed up till one year. The study was approved by local institutional ethics committee and informed consent was taken from participants. Data was analysed using SPSS ver 14. P value of 0.05 was taken as significant.

RESULTS

The mean age of the wind instrument players was 31 years (Standard Deviation (SD) = 4 years) (Range 25 -42 years). Total duration of wind instrument played by high wind instrument players varied from 540 hours to 4050 hours with mean of 2532.3 hours (SD = 868 hours). Mean years wind instrument players had played the wind instrument was 9.2 years (SD = 3.5).

Ocular examination:

Wind instrument players and controls had open angles, but significantly, multiple clumps of pigment were found in the angles in 72% of wind instrument players, only one pigment clump was found in two wind instrument players. Controls were found to have one pigment clump in 2 out of 22 individuals (9%). The individuals with maximum pigment clumps had been playing the instruments (tenotrome, clarinet, cornet and saxophone) for a period ranging from 9 years to 12 years. Goniosynechiae were found in three individuals who used to play cornet, saxophone, and clarinet (Fig-1).

Visual fields of wind instrument players and controls were normal. Both Mean Deviation and Pattern Standard Deviation of Humphrey's automated perimetry, 24-2 SITA standard, were not suggestive of glaucoma in all wind instrument players and controls. Optic nerve heads of all wind instrument players and controls were normal with no features suggestive of glaucoma.

Mean intraocular pressure on both the occasion is shown in table -1. Paired sample t test found statistical significant difference in intraocular pressure in both right and left eyes before playing the instrument and during playing it. Average difference between before IOP and during play IOP in right and left eye was 3.6 and 3.7 respectively (p value <0.001). However there was no statistical significant difference between before intraocular pressure and after intraocular pressure in both the eyes at both the occasion. No such intraocular difference was noted in controls.

The mean corneal thickness as measured by pachymetry in right and left eye were 540 (SD = 28.7) and 542 (SD = 29.1).

Clinical evaluation of all the members of the band (wind instrument player and control) was repeated after one year. There was no statistical significant change in IOP or any other clinical findings in all the individuals.

DISCUSSION

Playing wind instruments like trombone, saxophone, cornet, clarinet, oboe, bassoon, and French horn raise IOP. This has also been associated with greater incidence of visual field loss[3]. The likely mechanisms causing this rise of intraocular pressure are elevated episcleral venous pressure and increased orbicularis tone and uveal engorgement.[3, 4, 5] This rise of intraocular pressure is transient and decreases within a short time as seen in this experiment where intraocular pressure decreased within 10 minutes of ceasing to play though the exact time for intraocular pressure is not known as continuous intraocular pressures was not possible. The Valsalva maneuver associated with high-resistance instrument playing is thought to be responsible for raising the intraocular pressure, because it raises intra thoracic pressure with resultant compression of the intrathoracic venous system, decreasing venous return and increasing episcleral venous pressure and in turn, increasing IOP. [5,6,7]

This study evaluated change of IOP recorded by a hand held rebound tonometer in 22 male members of a brass band while playing variety of wind instruments. A statistically significant rise of IOP was noted during playing the wind instruments. IOP change from 13.79 ± 1.93 mmHg to 15.12 ± 2.44 mmHg, while playing a variety of wind instruments, has also been seen by Aydin et al, although all members did not show increase of IOP. His study showed that amongst four players of clarinet , two showed increase of IOP, one showed decrease and one showed no change of IOP. [5]

In our study, clumps of pigment were found in the angle of the anterior chamber signifying transient irido trabecular contact, possibly during the repeated episodes of valsalva maneuver during playing wind instruments. This finding was seen in individuals playing these instruments for many years and not in individuals who had been playing only for 2 to 5 years signifying that repeated valsalva maneuver was resulting in iridocorneal contact. Sihota et al, found significant elevation of IOP, narrowing of anterior chamber angle recess, thickening of ciliary body and increase in iris thickness during valsalva maneuver. They concluded that valsalva maneuver may lead to angle closure in eyes anatomically predisposed to angle closure.[8] Li et al, in a study on the effects of valsalva maneuver on anterior chamber parameters and choroidal thickness in healthy Chinese by anterior segment optical coherence tomography and swept-source optical coherence tomography, found that there was significant rise of IOP and decrease in anterior chamber parameters during valsalva maneuver but no significant change in choroidal thickness during Valsalva maneuver.[9] However , in a study of Dynamic changes in anterior segment morphology during the Valsalva maneuver assessed by ultrasound biomicroscopy by Wang Bing – Song et al , it was concluded that there can be significant narrowing of angles in both open and narrow angles during valsalva's maneuver during performance of daily tasks.[2]

All these studies show that iridocorneal contact may occur during valsalva's maneuver in both open and narrow angles. It is probable that, in participants of players of wind instruments, repeated iridocorneal contact does occur, especially when these instruments are played for long hours and for many years, especially playing higher frequency tunes. This iridocorneal contact may result in deposition of pigments in the anterior chamber angle.

Presence of blotchy pigments in the anterior chamber angle and peripheral anterior synechiae are considered diagnostic signs of primary angle closure. In a study by Rao et al for evaluating blotchy pigments in the anterior chamber angle as a sign of angle closure, it was found that blotchy pigments were seen in 36 open angle eyes of 756 eyes with open angles, a prevalence of 4.7% and more commonly in the inferior quadrant compared to other quadrants. The authors could not find a cause explaining the presence of such pigment. [11]

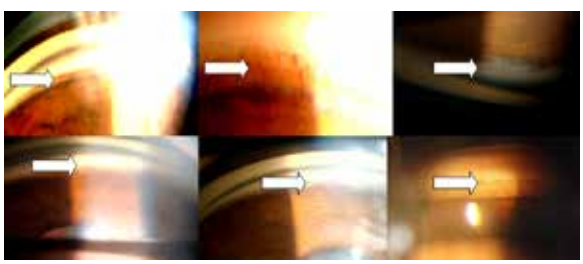
The blotchy pigments due to iridocorneal contact can result in trabecular damage, has been suggested by Kerman et al. Similarly Spencer et al have described progressive fibrosis and degeneration in the trabecular meshwork with compressed and obliterated Schlemm's canal beneath the iris adhesion in angle closure glaucoma.[12]

In our study definite statistical increase of IOP was found in all personnel and presence of blotchy pigments in 72% of them, suggesting that during the playing of these instruments

there is transient iridocorneal contact leaving a pigment deposit even in open angles. It may be pertinent to consider development of raised IOP in such patients, if followed up for a longer period due to damage to the trabecular meshwork. In this study none of the participants who were members of brass band had narrow or occludable angles but despite having widely open angles, they had evidence of angle closure by the presence of clumps of pigment in the angles in the members playing a variety of instruments. The visual fields did not show any changes nor were there any changes in the optic nerve heads in any of the band members. The limitation of our study is that a long time follow up could not be done on these participants due to administrative constraints.

To conclude, examination of eyes of wind instrument players should be performed prior to playing wind instruments and they should be advised a periodic review so that they do not suffer from glaucomatous damage.

Fig -1: Angles of anterior chamber in wind instrument players showing pigment clumps



		Wind instrument players			Controls		
		Before playing	During play	After play	Before playing	During play	After play
Occasion 1	Right eye	15.4(3)	19 (5.4)	15.6 (2.8)	15.1(3)	15.4(4)	15.4(3)
	Left eye	14.7 (2.7)	18.7 (4.6)	14.9 (3.7)	14.5(2)	15.2(3)	14.9(2)
Occasion 2	Right eye	15.8 (2.9)	19.5 (5.4)	15.6 (2.9)	15.2(2.1)	15.6(3)	14.9(2.4)
	Left eye	15.8 (3.3)	19.3 (4.4)	15.9 (4.4)	14.9(2.3)	15.2(3.2)	15.4(3)
Average	Right eye	15.6 (2.9)	19.2 (5.4)	15.6 (2.8)	15.1 (2.4)	15.5 (3)	15.2 (2.5)
	Lt eye	15.3 (2.8)	19 (4.4)	15.4 (4.2)	14.7 (2.1)	15.2 (3)	15.2 (3)

Table:1 Intraocular pressure recordings in wind instrument players and controls

REFERENCES

1. Zaher H. Sbeity, Ahmad M. Mansour**.** Recurrent retinal vein occlusion after playing a wind instrument. Graefe's Arch Clin Exp Ophthalmol(2004) 242:428–431.
2. Bing-Song Wang, Lin Xiao, Jing Liu, et al. Dynamic changes in anterior segment morphology during the Valsalva maneuver assessed with ultrasound biomicroscopy. Invest. Ophthalmol. Vis. Sci 2012;12-10497.
3. Schuman JS, Massicotte EC, Connolly S , et al. Increased intraocular pressure and visual field defects in high resistance wind players. Ophthalmology 2000; 107(1):127-33.
4. Gupta V. Constipation-related Migraine Is Linked To The Effect Of The Valsalva Maneuver On The Eye: A Case Report And A Mechanistic Review .Webcentral.com Neurology 2010;1(12).
5. Aydin P, Oram O , Ahman A, et al. Effect of wind instrument playing on intraocular pressure. Journal of Glaucoma 9;322-324.
6. Lanigan LP, Clark CV, Hill DW. Intraocular pressure responses to systemic autonomic stimulation. Eye (1989) 3, 477–483.
7. Carlos Gustavo V. De Moraes, Prata TS, Liebmann J, Ritch R . Modalities of Tonometry and their Accuracy with Respect to Corneal Thickness and Irregularities. J Optom 2008;1: 43-9 - Vol. 1.
8. Sihota R, Dada T, Aggarwal A, et al. Does an iridotomy provide protection against narrowing of anterior chamber angle during valsalva maneuver in eyes with primary angle closure, Eye 2008;22:389-393.
9. Li X, Wang W, Chen S,et al.. Effects of Valsalva Maneuver on Anterior Chamber Parameters and Choroidal Thickness in Healthy Chinese: An AS-OCT and SS-OCT Study. Investigative Ophthalmology & Visual Science July 2016, Vol.57, OCT 189-195.
10. Foster PJ, Buhrmann R, Quigley HA, et al. The definition and classification of glaucoma in prevalence surveys. Br J Ophthalmol 2002;86:238-42.
11. Rao HL, Mungale SC, Kumbar T, et al. Evaluation of blotchy pigments in the anterior chamber angle as a sign of angle closure. IJO 2012;60: 535-9.
12. Sihota R, Lakshmaiah NC, Walia KB, et al. The trabecular meshwork in acute and chronic angle closure glaucoma.IJO 2001;49, 255-9.