**Bijlage Literatuuronderzoek Glaucoom en saxofoon spelen**

**Uitkomsten van literatuuronderzoek**

Literatuuronderzoek levert enkele artikelen op waarin causaal verband wordt gelegd tussen intra-oculaire drukstijging, optreden glaucoom en langdurig bespelen van een blaasinstrument. Het eerste artikel dateert van 2000, zie ook bijlage.

Samengevat:

Hoewel open kamerhoek glaucoom een multifactoriële aandoening is, blijkt uit onderzoek een hoge intraoculaire druk (IOD) een significante invloed te hebben op het verloop van de aandoening. Bij elke verhoging van de gemiddelde IOD met 1 mm Hg neemt het risico op glaucoom toe met circa 10%. Over de invloed van fluctuaties in de oogdruk op het ontstaan van glaucoom bestaat onzekerheid.

Bij mensen die blaasinstrumenten bespelen treedt tijdens en direct na het spelen een verhoging van de IOD op, bij bespelers van blaasinstrumenten met hoge weerstand (BBHW) meer dan bij bespelers van instrumenten met lage weerstand (BBLW). Onderzoek wijst uit dat bij BBHW vaker gezichtsvelduitval voorkomt dan bij andere musici en dat dit gerelateerd is aan het aantal uren dat tijdens het leven is gespeeld. Door verhoging van de thoracale druk bij het spelen (Valsalva manoeuvre) wordt de veneuze afvoer uit het hoofd en dus ook uit de ogen geremd, wat de druk in de oogbol verhoogt.

Ook de techniek van spelen kan van invloed zijn. Uit onderzoek onder bespelers van koper- en houten blaasinstrumenten blijkt vooral het spelen van hoge tonen de IOD te verhogen, vooral wanneer hoge tonen lang worden aangehouden. Er zijn diverse gevallen van (normale) druk glaucoom bij professionele musici beschreven en ook een geval van verminderde visus tgv van afsluiting van de retina-vaten waarbij een zelfde mechanisme werd verondersteld. De conclusie van de meeste onderzoekers is dat musici die langdurig blaasinstrumenten bespelen het risico lopen glaucoom te ontwikkelen en daarom zou bij hen regelmatig de oogdruk moeten worden gemeten.

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**Overzicht relevante abstracts**

Relationship between intraocular pressure and glaucoma onset and progression

Open-angle glaucoma is a multifactorial disease, and among the several risk factors, a high intraocular pressure represents the most consistent and the only one that can be modified in order to provide a significant impact over the course of the disease. High intraocular pressure is significantly associated to the onset and the progression of open angle glaucoma, and the results of several randomised controlled clinical trials have consistently attributed a 10% higher risk for both the development and the progression of the disease to each higher single mmHg. Intraocular pressure has been studied in terms of mean value and short-term and long-term fluctuations. As of today the mean value represents the most significant factor whereas the importance of both short-term and long-term fluctuations is still debated. (Miglior & Bertuzzi, 2013)

Increased intraocular pressure and visual field defects in high resistance wind instrument players

In this twofold study, part 1 aimed to determine whether the playing of high resistance wind instruments elevates intraocular pressure (IOP) and if so, to investigate the mechanism of IOP elevation and whether its magnitude differs while playing high resistance versus low resistance instruments. The purpose of part 2 was to evaluate whether high resistance players have a greater incidence of glaucomatous changes than other musicians.   
Results: High and low resistance wind musicians experience a transient rise in their intraocular pressure (IOP) while playing their instruments as a result least in part of uveal engorgement. The magnitude of IOP increase is greater in high resistance wind players versus low resistance wind players. High resistance wind musicians had a small but significantly greater incidence of visual field loss (abnormal fields and increased CPSD scores) than other musicians, which was related to life hours of playing. The cumulative effects of long-term intermittent IOP elevation during high resistance wind instrument playing may result in glaucomatous damage, which could be misdiagnosed as normal-tension glaucoma. (Schuman et al., 2000)

Effect of wind instrument playing on intraocular pressure

*Purpose*: To evaluate the effect of wind instrument playing on intraocular pressure.   
*Methods*: In a prospective, nonrandomized clinical trial, 24 eyes of 24 wind instrument players with no history of any ocular or systemic disease were evaluated. The musicians were members of Bilkent Academic Symphony Orchestra of Bilkent University in Ankara. A complete eye examination, including best-corrected visual acuity, slit-lamp examination, and fundus examination, was performed. The intraocular pressure was measured before and after a 90-minute rehearsal of a piece by Wagner. All intraocular pressure measurements were carried out by the same researcher using Goldmann applanation tonometry. The difference in intraocular pressure measurements before and after the 90-minute wind instrument-playing performance was analyzed.   
*Results*: The mean intraocular pressure was 13.79 +/- 1.93 mm Hg before and 15.12 +/- 2.44 mm Hg after the performance. Wind instrument playing significantly increased the mean intraocular pressure by 9.6% (P = 0.0149).   
*Conclusion*: These results indicate that wind instrument playing may significantly increase intraocular pressure in healthy patients. The significance of this finding for patients with suspected normal-tension or high-tension glaucoma needs further evaluation. (Aydin, Oram, Akman, & Dursun, 2000)

Intraocular pressure fluctuations in professional brass and woodwind musicians during common playing conditions

BACKGROUND: We investigated the effects on intraocular pressure (IOP) and blood pressure (BP) of playing brass and woodwind instruments by monitoring IOP and BP in a representative group of professional musicians under a variety of common playing conditions.  
METHODS: IOP and BP measurements were recorded from 37 brass and 15 woodwind instrument players, before and after playing tones of low, middle and high frequency. We also measured IOP and BP before and during playing common exercises of 10 minutes duration, as well as after playing a sustained high-pitched tone, to test for changes in IOP under conditions of maximum effort.  
RESULTS: Playing tones on brass and woodwind instruments causes a temporary elevation in IOP and BP, depending on the tone frequency: brass instrument players showed a significant elevation after playing high and middle frequency tones (p < 0.0001) whereas woodwind instrument players showed a significant increase only for high frequencies (e.g., oboe, 17 ± 2.9 mm Hg to 21 ± 4.4 mm Hg; p = 0.017). Playing a typical exercise of 10 minutes temporarily increased IOP in both groups of musicians. Finally, playing a sustained tone of high pitch caused a significant elevation in IOP in brass instrument players only (16.6 ± 3.5 mm Hg to 23.3 ± 8.9 mm Hg; p < 0.0001).  
CONCLUSIONS: The temporary and sometimes dramatic elevations and fluctuations in IOP observed in this study, coupled with daily exposure to instrument play, puts professional wind instrument players at increased risk of developing glaucoma. Consequently, these musicians should be monitored for signs of glaucoma, especially those with co-existing risk factors. (Schmidtmann, Jahnke, Seidel, Sickenberger, & Grein, 2011)

Das Blasinstrument, Risiko bei Glaukom? Ein Fallbericht

Musicians, playing high resistance wind instruments, experience a transient rise in IOP as a result of uveal engorgement. In the present case of a 68-year-old professional musician (trumpeter) suffering from glaucoma, the cumulative effect of long-term intermittent IOP elevation during high resistance wind instrument playing appeared to represent an additional risk factor resulting in further visual field deterioration. (Strasser & Thaler, 2000)

Transitorische intrathorakale und -abdominale Druckerhöhung in der Anamnese von 64 Patienten mit Normaldruckglaukomen

*Background*: As one pathogenetic factor in normal-tension glaucoma an individually elevated sensitivity of lamina cribrosa regarding intraocular pressure fluctuations is postulated. Aim of this study was to evaluate patients with normal-tension glaucoma for the exposure to potential, clinically undetected transient elevations of intraocular tension due to increased intrathoracic and -abdominal pressure.

*Patients and methods*: A survey of 64 patients of the "Erlanger Glaucoma registry" with normal-tension glaucoma (NTG) and 64 patients with primary open angle glaucoma (pOAG) as control group were performed with regard to activities respectively diseases causing intrathoracic or -abdominal pressure elevation (1. weight lifting, 2. playing high resistance wind instruments, 3. chronic asthma/ cough, 4. obstruction of the urinary system, 5. constipation). Both groups were matched regarding age (median: 61 years), sex (24 male, 40 female), visual field defects (mean defect: NTG 4.4; pOAG 4.7), visual acuity (median 1.0 +/- 0.2) and systemic diseases (diabetes mellitus, hypertension, cardiac disease).

*Results*: Among patients with NTG there were 45% (29/64 patients) with activities respectively diseases causing intrathoracic or intraabdominal pressure elevation in their medical history compared to 11% (7/64) among patients with pOAG. Male patients with normal-tension glaucoma showed with 62% the highest frequency of such activities (among them 4/24 high resistance wind instrument playing, 5/24 urinary system obstructions, 4/24 long time weight lifting). Female patients with normal-tension glaucoma most frequently presented with a history of weight lifting (11/40).

*Conclusion*: Patients with glaucomatous optic nerve atrophy without evident intraocular pressure elevation compared to patients with pOWG more frequently report activities or diseases causing intrathoracic/-abdominal pressure elevation in their medical history. This may suggest an additional pathomechanism in normal-tension glaucoma. Therefore patients may be adviced on these potential risk factors. (Krist, Cursiefen, & Jünemann, 2001)

Intraocular Pressure During Wind Instrument Playing

*Purpose*: It is assumed that while playing wind instruments a Valsalva manoeuvre is performed which induces a rise in intraocular pressure (IOP). The extend of this rise during and after playing of low and high resistance wind instruments in healthy musicians has not yet been assessed.

*Methods*: IOP was measured by rebound tonometry in the sitting position before, during and after playing of high and low resistance wind instruments. The measurements were obtained in 32 lay and players with high and low resistance instruments in two settings: during normal and forced (loud and high pitched notes) playing intervals and in 14 professional players with high resistance instruments during forced playing intervals.

*Results*: In lay players in low resistance instruments baseline IOP was 17,2 ± 3,2 mmHg. During normal playing there was a mean increase of 1,7 ± 0,2 mmHg. After cessation of playing the IOD fell below baseline pressures with a mean of 16,2 ± 4,5 mmHg.

With high resistance instruments in lay players the mean IOD before playing was 17,3 ± 2,9 mmHg, during the minute of playing a normal tune we found a mean rise in IOP of 2,7 ± 0,3 mmHg which decreased immediately after cessation of playing to 16,6 ± 3,6 mmHg. During forceful (loud and high notes) playing the IOD rose by a mean of 9,2 mmHg to 26,5± 7,7 mmHg. The highest value was found in a male trumpet player with 42 mmHg. Immediately after playing the IOD fell to 15,7 ± 3,1 mmHg. In professional players with high resistance instruments the baseline IOP was 14,4 ± 3,9 mmHg and rose to 20,4 ± 6,7 mmHg during forceful playing. After cessation of playing the IOP fell to 15,6± 2,7 mmHg.

Conclusions: IOP changes, especially those found during forceful playing with high resistance wind instruments, can significantly increase the IOP in healthy eyes. Professional players also experience an increase in IOP during playing sequences. The IOP increase might be less pronounced than in lay players due to a better training effect in the necessary musculature. (Lantzl, Kappmeyer, & Kotliar, 2012)

Recurrent retinal vein occlusion after playing a wind instrument

PURPOSE: To present a complication of repeated Valsalva maneuver.

METHODS: Case report with serial intravenous fluorescein angiography and comprehensive workup for coagulopathies.

RESULTS: After playing strenuous musical pieces, a solo trombonist suffered within 1 year three attacks of visual loss in the right eye; he had two attacks of inferior hemi-central retinal vein occlusion 2 months apart, followed by central retinal vein occlusion 10 months later. Final best spectacle-corrected visual acuity was 6/60. He ended his professional career, and no further attacks occurred in the following 10 years.

CONCLUSION: Retinal vein occlusion with irreversible visual loss can occur after playing a strenuous piece of music on a high-resistance instrument. (Sbeity & Mansour, 2004)