

Relationship between Glaucoma, Pseudoexfoliation and Pseudoexfoliative Glaucoma with Sensorineural Deafness

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ABSTRACT

Objective: To study whether there is an increase in the frequency of sensorineural hearing loss among patients suffering from primary open angle glaucoma, pseudoexfoliation syndrome and pseudoexfoliative glaucoma.

Methods: This is a cross-sectional study conducted at the ophthalmology and ENT clinic of prince Ali Bin Al-Hussein military hospital between Jan.2012 and Aug 2013. All patients who attended to the ophthalmology clinic and found to have primary open angle glaucoma, pseudoexfoliation syndrome or pseudoexfoliative glaucoma were referred to the ENT clinic for hearing assessment after performing detailed ophthalmological -examination. Those results were compared with that of a control group.

Results: Sensorineural hearing loss was found in 6% of patients in the control group and in 9.7% (p value > 0.05) of patients with primary open angle glaucoma. On the other hand it was found in 34.3 % (p value < 0.05) and 30.3 % (p value < 0.05) among patients with pseudoexfoliative glaucoma and pseudoexfoliation syndrome respectively.

Conclusion: This study provides evidence regarding the effect of pseudoexfoliation of the eye and its severity on the frequency of sensorineural hearing loss which in turn suggests that pseudoexfoliation syndrome is a systemic disease which may have otological involvement manifested as sensorineural hearing loss.

Key words: Glaucoma, Pseudoexfoliation, Sensorineural hearing loss

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Introduction

Glaucoma is one of the leading causes of blindness which is attributed to glaucomatous optic neuropathy. In addition to elevated intra ocular pressure, other factors were implicated in causing damage to the optic nerve fibers in glaucoma patients which include cardiovascular, hematological, genetic and immunological aspects.⁽¹⁾ Pseudoexfoliation syndrome (PEX) is a

relatively common condition affecting the eyes and characterized by deposition of fibrillar substance in abnormally high concentrations within ocular tissues.⁽²⁾ It was only in 1917 when a Finnish ophthalmologist named Lindberg described this syndrome.⁽³⁾ Some studies provided evidence of extra ocular involvement like the skin, aorta, brain, heart, kidney and parabolbar tissues.⁽⁴⁾ It is estimated that 30% of

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people older than 60 years are affected by PEX, it is usually unilateral involving the iris, zonules, anterior lens capsule and trabecular meshwork and nearly half of the affected eyes suffer from elevated intra ocular pressure.⁽⁵⁾ In addition to that, PEX is considered the most common cause of secondary open angle glaucoma named pseudoexfoliative glaucoma.⁽⁶⁾ Sensorineural hearing loss (SNHL) is also relatively common in the population, its prevalence among all age group was found to be 16.1% in USA and it increases with age.⁽⁷⁾

Different studies showed a significant association between PEX and sensorineural hearing loss SNHL; Cahill et al. believed that the presence of PXF, rather than glaucoma, is associated with hearing loss.⁽⁵⁾ In addition, Thabit et al. found that severe sensori-neural hearing loss ranging between 70-95 decibels hearing level was found in 38.3% of patients, Reham *et al.* also reported that the majority of patients with ocular PXF had sensorineural hearing loss compared to age-matched controls.^(8,9) This study was conducted to explore whether there is an increase in the frequency of SNHL among patients suffering from primary open angle glaucoma, pseudoexfoliation syndrome and pseudoexfoliative glaucoma.

Methods

This is a cross-sectional study conducted at the ophthalmology and ENT clinic of prince Ali Bin Al-Hussein military hospital between January 2012 and August 2013. All patients who attended to the ophthalmology clinic and found to have primary open angle glaucoma, pseudoexfoliation syndrome or pseudoexfoliative glaucoma (PEXG) were referred to the ENT clinic for hearing assessment. Fifty patients who had none of the previous conditions were also sent for hearing assessment as a control group.

Patients with previous ocular or ear surgeries or trauma, history of tympanic membrane perforation, patient with conductive hearing loss and patients with history of ototoxic drugs usage were excluded from the study. Patients with increased risk for elevated intra ocular pressure (IOP) like those using steroids and patients with uveitis were also excluded, patients with angle closure glaucoma and those with other causes of secondary open angle glaucoma and patients with

any ocular diseases which may have association with Sensorineural hearing loss were also excluded from the study. After taking detailed history patients underwent careful ophthalmologic examination which included best corrected visual acuity, anterior and posterior segment examination, IOP measurement using Goldmann tonometry and gonioscopy. In addition, HVF and OCT of retinal nerve fibre layer were performed to all patients.

The severity of Pseudoexfoliation was assessed as grade 0 where there was no pseudoexfoliation and grade 1, 2, 3 and 4 according to the number of quadrants affected by this syndrome. After that all patients were referred to the ENT clinic for hearing assessment where Pure tone audiometry was performed to all patients; hearing threshold levels measurement was done at 250, 500, 1000, 2000, 3000, 4000, and 6000 HZ.

Results

Two hundred patients aged between 45 and 82 years (mean 64.7 ± 12.2 years) were enrolled in the study. Patients were divided into four groups according to their clinical findings; group A (50 patients) were those who didn't have primary open angle glaucoma, pseudoexfoliation syndrome or pseudoexfoliative glaucoma, group B (82 patients) were those who had only primary open angle glaucoma. Group C (35 patients) were those who had only pseudoexfoliative glaucoma, and group D (33 patients) were those who had only pseudoexfoliation syndrome.

Table I represents the demographic features for all groups. Table II summarizes the frequency of sensorineural hearing loss among the four groups. Group B, C and D were compared with group A; One way analysis of variance was used to investigate the significant difference among groups. Student Newman Keuls test was used to investigate any significant difference among the four groups. P value was considered significant if < 0.05 .

Sixty seven of patients enrolled in this study had pseudoexfoliation which was bilateral in 31 patients, 20 patients had right eye involvement and 16 patients had left eye involvement. SNHL was found in 33 patients which was bilateral in 10 patients. Twelve patients had right SNHL and 9 patients had left ear involvement.

Table III summarizes the severity scales of pseudoexfoliation and the frequency of SNHL.

Table I: The demographic features for all groups.

Group	A (n=50)	B (n=82)	C (n=35)	D (n=33)
Mean age	64.2	65.8	66	63
Male:female ratio	1.1:1	1.2:1	1.1:1	1.1:1

Table II: The frequency of sensorineural hearing loss among the groups.

Group	A (n=50)	B (n=82)	P value	C (n=35)	P value	D (n=33)	P value
No. of patients with sensorineural hearing loss	3	8	>0.05	12	<0.05	10	<0.05
Percentage	6%	9.7%		34.3%		30.3%	

Table III: The severity scales of pseudoexfoliation and the frequency of SNHL

Score of PEX	0	1	2	3	4
Number of patients	132	12	14	33	9
Number of patients with sensorineural hearing loss	11	2	4	12	4
Percentage	8.3%	16.7%	28.6%	36.4%	44.4%

Table IV: The bilateralism of eye and ear involvement

	Bilateral PEX (n=8)	Right PEX (n=7)	Left PEX (n=7)
Bilateral SNHL(n=7)	2	2	3
Right SNHL(n=10)	4	3	3
Left SNHL(n=5)	2	2	1

Twenty two patients had both pseudoexfoliation and SNHL; 8 patients had bilateral pseudoexfoliation and only two had bilateral SNHL. In addition 7 patients had right eye pseudoexfoliation but only 3 patients had only right SNHL, 2 patients had left SNHL and 2 patients had bilateral SNHL. Only 5 out of the 22 patients had the same side(s) of eye and ear involvement.

Table IV shows the bilateralism of eye and ear involvement.

Discussion

In this study we attempted to explore any relationship between primary open angle glaucoma, PEX syndrome and pseudoexfoliation glaucoma from one side and sensorineural hearing loss SNHL by comparing those results with a control group. Some studied found a significant relationship between pseudoexfoliation syndrome and SNHL among Jordanian patients,^(8,9) in our study we included patients with primary open angle glaucoma and pseudoexfoliative glaucoma as well.

Our comparative study consisted of four groups. We did not find significant difference between the four groups regarding age and sex. In this study the frequency of SNHL in group A and B was 6% and 9.6% respectively, this percentage didn't exceed what was found in the general population (16.1%).⁽⁷⁾ The exact mechanism of glaucomatous optic neuropathy is not known, although many risk factors have been identified including mechanical and vascular aspects. Some studies reported an increase in frequency of SNHL in normal tension glaucoma but not open angle glaucoma, Kermer *et al* found elevated level of antibodies against phosphatidylserine in patients with SNHL and normal tension glaucoma compared to normal population and patients with primary open angle glaucoma suggesting a common general pathology.⁽¹⁰⁾ On the other hand patients with PEX and PEXG showed a significant higher frequency for SNHL(p value <0.05) , which was slightly more frequent in PEXG patient (34.3%) than PEX (30.3%). This may suggest that PEXG represents more advanced presentation of PEX.

This study supported previous reports about the strong relationship between PEX and SNHL. In addition, we found no relationship between open angle glaucoma and SNHL.⁽¹¹⁻¹⁵⁾ Our study adds to previous papers the differences between the severity of PEX and the frequency and severity of SNHL. The frequency SNHL showed to be as high as 44.4% in the most severe forms of PEX when compared to mild forms of PEX (16.7%). This also suggests a shared pathology between PEX and SNHL.⁽¹⁶⁾ One of the hypothesis which was presented to explain this is the deposition of exfoliative fibrillar substance in the organ of Corti of the inner ear which affect the transmission of vibration energy to the neurosensory hair cells resulting in alterations in the chemical composition of the surrounding environment.⁽⁵⁾ This explanation is supported by the fact that anterior eye segment and tectorial and basilar membranes of the organ of Corti have a common embryological origin.^(17,18)

We also investigated the bilaterality of the lesion, a factor that hasn't been taken in consideration in previous studies. We found that there was no difference in frequency between the side of eye involvement with PEX and the side of the SNHL.

Conclusion

This study confirms the effect of pseudoexfoliation of the eye and its severity on the frequency of sensorineural hearing loss which in turn suggests that pseudoexfoliation syndrome is a systemic disease which may have otological involvement manifested as sensorineural hearing loss. Routine otological evaluation including audiometry is essential for patients with ocular pseudoexfoliation.

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