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Risk factors for open angle glaucoma, a hospital based study in Kinshasa

by

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Abstract

Purpose: *To compare the prevalence of open-angle glaucoma (OAG) between different ethnic groups (Mongo, Kongo and other ethnic group) in Congolese patients.*

Methods: *A cross-sectional study of all patients in a University referral practice (7560 patients) and a general practice of ophthalmology (4172 patients) seen between 1991 and 1995. All patients were categorized by ethnic group (Mongo, Kongo or other).*

Results: *The distribution of OAG by ethnic group was significantly different between the Mongo ethnic group (5%), and the Kongo (2%) and "other" ethnic groups (2%) ($p < 0.001$). There were no significant differences ($p > 0.05$) between ethnic groups in the mean age (53 years), the predominance of men (sex ratio, 2:1), the mean intraocular pressure (31 mmHg) and the mean cup:disk ratio (0.8) at the time of diagnosis.*

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Conclusion: *OAG seems to be more frequently in the Mongo ethnic group than in others. Further analysis based on population-based data may be useful.*

Key-Words

Open-angle glaucoma. Ethnic group. Prevalence.

Introduction

It is well known that the prevalence of glaucoma is higher in black people, develops at an earlier age, and is more severe when compared with white people (1-7). On the basis of clinical observations, we suspected that some ethnic groups develop more open-angle glaucoma (OAG) than others in the Democratic Republic of Congo. Especially, it has been the impression that OAG is more frequently in the Mongo ethnic group than in other ethnic groups of the region. Valid evidence to support this view is lacking. Therefore a study was launched to test the hypothesis that the prevalence of glaucoma is larger in Mongo people than in Congolese inhabitants from other ethnic groups.

Patients and methods

The design of this study was a cross-sectional study. Patients considered in this study were all consecutive patients examined between 1991 and 1995 at the Department of Ophthalmology, University of Kinshasa (University referral practice) and at the private clinical practice (general practice of ophthalmology) of one of us (KWK.D). Each patient had a complete ophthalmic examination including testing of the visual acuity, inspection of the adnexa, refraction, split-lamp examination, ophthalmoscopy, intraocular pressure measurements, gonioscopy and Goldmann visual field testing.

Ocular examination

The diagnosis of OAG was based on the presence of elevated intraocular pressure, in combination with a glaucomatous visual field

defect on Goldmann perimetry, and a vertical cup:disc ratio of 0.6 or greater, with a normal and open anterior chamber angle, and without any other abnormality that could have caused the visual field defect. For each patient, data on age, sex, ethnicity, initial date of presentation, vertical cup:disc ratios, grading of the visual field, intraocular pressure (IOP), history of medical and non-medical therapy were collected. The assessment of disc damage (vertical cup:disc ratio) was made in comparison with nine standard drawings labeled 2 to 10, corresponding to the vertical cup-to-disc ratio shown (0.2 to 1.0). The visual fields defects included an arcuate scotoma continuous with the blind spot and extending beyond 50° below or 45° above the horizontal, a paracentral scotoma larger than 5°, a nasal step larger than 10°, or an advanced glaucomatous visual field loss (loss of most of the upper or lower visual field or central or temporal island remnants). Visual field defects were classified as early, moderate or severe. Early defects included isolated nasal step, paracentral scotoma, or other small scotoma. Moderate defects included nasal step together with paracentral scotoma, arcuate scotoma in one half of the field together with a paracentral scotoma or nasal step in the other half. Advanced defects included double arcuate scotomas, loss of the superior or inferior hemifield, and central or temporal island remnants.

Ethnicity

The Democratic Republic of Congo comprises more than 400 tribes which are grouped in nine principal ethnic subgroups. The nine largest simple ethnic subgroups are the Mongo, Kongo, Luba, Lunda, Kuba, Bemba, Batshi, Azande and Hunde-Shi. Patients belonging to each of these ethnic groups live in Kinshasa, but the Kongo, Luba and Mongo form the most numerous groups. Kongo and Mongo live in the neighborhood of Kinshasa, the Luba come from the more distant Kasai. In order to be able to compare patients from different tribes living in the city of Kinshasa with those living in a rural environment, special attention was given to the Mongo and Kongo ethnicities. Therefore, in this study, patients were categorized by ethnic groups in one of three classes: Mongo, Kongo and "other". The "other" ethnic group comprised patients who did not belong to either the Mongo or the Kongo tribes. The concept of ethnicity implies, here, the following: shared origins or social background, shared culture, diet and traditions that are distinctive, maintained between generations, and leading to a sense of identity and group; and a common language tradition (8).

Statistical methods for analysis included the Chi-square, the Mantel-Haenszel test (9) for linear trend for an association between discrete

variables and the Student's t test to compare means. Adjustment for co-variables included Mantel-Haenszel stratified analysis. A p value of .05 or less was considered statistically significant. Multiple logistic regression analysis was performed starting from a full hierarchical model. Dependent variable was the presence of OAG. Independent variables were ethnic group (Mongo or other), gender, age-group (0-50, 51-60, > 60), type of practice (University or general practice) and 2 variables (products) interaction terms for the ethnic group and the other independent variables. Removal of terms was based on log likelihood p values, using 0.10 as the cut-off.

Results

A total of 7560 patients and 4172 patients were seen at the department of ophthalmology, university of Kinshasa and at the private practice respectively. The overall distribution of the populations (from the two

TABLE 1
Characteristics of all patients

Variables	All patients Practice	University practice	Private	p value
N	11732	7560	4172	
Age, years				0.07
Mean ± SD	32 ± 14	31 ± 14	32 ± 14	
Gender				0.9
Male	6208 53%	3997 53%	2211 53%	
Female	5524 47%	3563 47%	1961 47%	
Ethnic group				0.1
Mongo	1333 11%	832 11%	501 12%	
Kongo	3285 28%	2117 28%	1168 28%	
Other	7114 61%	4611 61%	2503 60%	
Refraction				0.9
Emmetropia	8446 72%	5443 72%	3003 72%	
Hyperopia	939 8%	605 8%	334 8%	
Myopia	2347 20%	1512 20%	835 20%	
Cup/disc ratio, mean ± SD				1.0
RE	0.3 ± 0.2	0.3 ± 0.2	0.3 ± 0.2	
LE	0.3 ± 0.2	0.3 ± 0.2	0.3 ± 0.2	
IOP, mean ± SD (mmHg)				1.0
RE	16 ± 11	16 ± 10	16 ± 12	
LE	16 ± 11	16 ± 10	16 ± 12	

RE = right eye
LE = left eye
IOP = intraocular pressure

TABLE 2
Demographic characteristics of all patients by ethnic groups

Variables	All		Mongo		Kongo		Other		p value
N	11 732		1333		3285		7114		
Age, years									0.06
Mean ± SD	32 ± 14		32 ±14		32 ± 15		31 ± 14		
Gender									0.75
Male	6208	53%	700	52.5%	1633	50%	3875	54%	
Female	5524	47%	633	47.5%	1652	50%	3239	46%	
Age group, years									0.60
0-50	9374	80%	1067	80%	2508	76%	5799	82%	
51-60	1262	11%	135	10%	385	12%	742	10%	
> 60	1096	9%	131	10%	392	12%	573	8%	

Institutions) closely resembles the demographic composition of the ethnic groups of the city of Kinshasa area, but age groups showed a higher participation of patients aged over 50 years (20% in this study but 5% of the total population of Kinshasa) (general census (10)).

The general characteristics of the study populations are summarized in tables 1 and 2.

There were no significant differences between the two populations (University and private) by age ($p = 0.07$), gender ($p = 0.90$), or ethnic group ($p = 0.10$) (table 1).

The median age for both populations of glaucoma patients was approximately 56 years. OAG was diagnosed in 289 patients: 162 patients from the University referral patients and 127 patients from the private practice patients. Table 3 gives information concerning the characteristics of the two populations of glaucoma patients. The refraction status in the two populations was similar ($p = 0.77$). However, the vertical cup/disc ratio ($p = 0.008$) and the IOP ($p = 0.03$) differed between the two populations in such a way that university hospital patients tended to be worse than those seen in private practice. There were no differences between non glaucoma patients for these parameters in the two populations.

The prevalence of OAG is given in table 4. The relative risk of OAG in Mongo people compared to the other tribes was 2.13 (95% confidence interval 1.61-2.78) after adjustment for the practice using Mantel-Haenszel stratified analysis. There was no confounding by practice.

The ratio of OAG for Mongo ethnic group patients was higher (Chi-square for trend, $p = 0.0019$) at every age than for Kongo and other ethnic

TABLE 3
Characteristics of glaucoma patients

Variable	University practice N = 162 / 7560	Private practice N = 127 / 4172	P value
Age, years			0.18
Mean ± SD	52.9 ± 13	55.0 ±10	
Median	56.5	56	
Range	14 – 84	22 – 88	
Gender			0.59
Male	114 70%	93 73%	
Female	48 30%	34 27%	
Ethnic subgroup			0.6
Mongo	33 20%	29 23%	
Kongo	44 27%	33 26%	
Other	85 52%	65 51%	
Ocular variables:			
Vertical cup/disc ratio, mean ± SD			
R.E.	0.81 ± 0.16	0.74 ± 0.20	0.008
L.E.	0.81 ± 0.16	0.74 ± 0.20	0.008
IOP, mean ± SD			
R.E	30.9 ± 8.9	28.8 ± 11	0.07
L.E.	31 ± 9	29.9 ± 11	0.03
Refraction			0.77
emmetropia	96 59%	74 57%	
hyperopia	42 26%	34 27%	
myopia	24 15%	20 16%	

R.E. = right eye
L.E. = left eye

TABLE 4
Prevalence of OAG

Variables	All patients				University practice				Private practice			
	Oag	%	No OAG	Total	Oag	%	No OAG	Total	Oag	%	No OAG	Total
Gender												
Male	210	3.4	5998	6208	114	2.9	3883	3997	96	4.3	2115	2211
Female	79	1.4	5445	5524	48	1.3	3515	3563	31	1.6	1930	1961
Total	289	2.5	11443	11732	162	2.1	7398	7560	127	3.0	4045	4172
Age group												
0 – 50	105	1.1	9269	9374	59	1.0	6024	6083	46	1.4	3245	3291
51 – 60	74	5.9	1188	1262	39	5.2	710	749	35	6.8	478	513
> 60	110	10.0	986	1096	64	8.8	664	728	46	12.5	322	368
Ethnic group												
Mongo	62	4.7	1271	1333	33	4.0	799	832	29	5.8	472	501
Kongo	77	2.3	3208	3285	44	2.1	2073	2117	33	2.8	1135	1168
Other	150	2.1	6964	7114	85	1.8	4526	4611	65	2.6	2438	2503

group patients in the two populations. The proportion of OAG rose with increasing age for all ethnic group patients. We observed a nine-fold increase in prevalence for the patients aged 60 years or older, compared with those under 50, and this increase didn't significantly differ between Kongo, Mongo and other ethnic groups.

In all ethnic groups, there was a significant difference in the ratio of OAG by gender. In the Mongo people the ratio of OAG among men was 5.4% (University practice) and 6.9% (private practice). For women the ratio was 2.45% (University practice) and 4.4 (private practice). In Kongo and other ethnic groups a similar pattern of proportions of OAG by gender was present. Overall, the relative risk of OAG was twice as high for men compared to women (adjusted for practice) (Odds ratio, 2.44; 95% confidence interval 1.86-3.19) (tables 5 and 6).

TABLE 5

Age-sex specific distribution of open angle glaucoma in 7560 patients

Ethnic group	University practice								
	Male			Female			Total		
	All patients	OAG	%	All patients	OAG	%	All patients	OAG	%
Mongo: age groups, yrs									
0-50	344	9	2.6	322	3	0.9	666	12	1.8
51-60	30	5	16.7	45	4	8.9	75	9	12.0
> 60	50	9	18.0	41	3	7.3	91	12	13.0
total	424	23	5.4	408	10	2.5	832	33	4.0
Kongo: age groups, yrs									
0-50	767	9	1.2	853	4	0.5	1620	13	0.8
51-60	114	7	6.1	119	2	1.7	233	9	3.9
> 60	156	11	7.1	108	11	10.2	264	22	8.0
total	1037	27	2.6	1080	17	1.6	2117	44	2.1
Other: age groups, yrs									
0-50	2054	23	1.1	1743	11	0.6	3797	34	0.9
51-60	254	16	6.3	187	5	2.7	441	21	5.1
> 60	228	25	11.0	145	5	3.4	373	30	8.1
total	2536	64	2.5	2075	21	1.0	4611	85	1.8
Total	3997	11	2.9	2563	48	1.3	7560	162	2.0

TABLE 6
Age-sex specific distribution of open angle glaucoma in 4172 patients

Ethnic group	University practice								
	Male			Female			Total		
	All patients	OAG	%	All patients	OAG	%	All patients	OAG	%
Mongo: age groups, yrs									
0-50	204	8	3.9	197	4	2.0	401	12	3.0
51-60	40	4	10.0	20	5	25.0	60	9	15.0
> 60	32	7	22.0	8	1	12.5	40	8	20.0
total	276	19	6.9	225	10	4.4	501	29	5.8
Kongo: age groups, yrs									
0-50	438	6	1.4	450	6	1.3	888	13	1.5
51-60	93	12	12.9	59	1	1.7	152	8	5.3
> 60	65	7	10.8	63	1	1.6	128	12	9.4
total	596	25	4.2	572	8	1.4	1168	33	2.8
Other: age groups, yrs									
0-50	1071	17	1.6	931	4	0.4	2002	21	1.0
51-60	161	12	7.5	140	6	4.3	301	18	6.0
> 60	107	23	21.5	93	3	3.2	200	26	13.0
total	1339	52	3.9	1164	13	1.1	2503	65	2.6
Total	2211	96	4.3	1961	31	1.6	4172	127	3.0

We also studied other demographic and ocular variables of OAG patients by ethnic group in each of the two populations (University and private). Table 7 gives the results. As stated before ocular pressure and cup:disk ratios were significantly worse in the university hospital patients. However, there were no significant differences between the glaucoma patients belonging to the three ethnic groups. Age, gender, as well as mean IOP and mean vertical cup/disc ratio were not significantly different in glaucomatous patients from Mongo, Kongo and others (ethnic groups) in any of the two populations. No statistically significant differences were found regarding visual field defects between the three ethnic groups in the two populations. Advanced glaucomatous visual field loss was found in approximately 33% of the patients in each ethnic group.

TABLE 7
Ocular variables (IOP and Cup/disc ratio) of OAG patients by ethnic subgroup in the two populations

University practice (n = 162)						
Variable	Mongo		Kongo		Others	
	R.E.	L.E.	R.E.	L.E.	R.E.	L.E.
IOP						
No, of eyes with IOP of						
> 21	27	27	32	30	62	65
< 21	4	4	9	13	16	14
Unknown	2	2	3	1	7	6
Mean ± SD	29 ± 6	32 ± 8	29 ± 6	30 ± 9	28 ± 9	32 ± 9
Cup/disc ratio						
No, of eyes with cup/disc of						
> 0.6	28	31	32	28	66	68
< 0.6	3	1	3	9	9	7
Unknown	2	1	9	7	10	10
Mean ± SD	0.8 ± 0.16	0.8 ± 0.17	0.8 ± 0.16	0.7 ± 0.21	0.8 ± 0.16	0.8 ± 0.15
Private practice (n = 127)						
Variable	Mongo		Kongo		Others	
	R.E.	L.E.	R.E.	L.E.	R.E.	L.E.
IOP						
No, of eyes with IOP of						
> 21	15	18	19	18	39	40
< 21	11	8	8	9	19	18
Unknown	4	4	5	5	7	7
Mean ± SD	28 ± 10	30 ± 10	31 ± 11	27 ± 10	28 ± 11	33 ± 13
Cup/disc ratio						
No, of eyes with cup/disc of						
> 0.6	17	17	25	25	37	38
< 0.6	9	7	2	2	15	15
Unknown	3	5	6	6	13	12
Mean ± SD	0.7 ± 0.19	0.7 ± 0.20	0.8 ± 0.15	0.8 ± 0.15	0.7 ± 0.21	0.7 ± 0.21

R.E. = right eye
L.E. = left eye
IOP = intraocular pressure

TABLE 8

Relation between presence of OAG and possible determinants, odds ratios (and 95% confidence intervals) resulting from mutiple logistic regression analysis (n = 11,732)

Variables	Odds Ratio	95% Confidence Interval
Ethnic group (Mongo/other)	2.19	1.62 – 2.95
Sex (male/female)	2.34	1.77 – 3.08
Age group (> 60 y/other)	3.08	2.70 – 3.51
Type of practice (University / Private)	0.69	0.53 – 0.88

Table 8 presents results of multivariate logistic regression analysis, after removing all interaction terms and retaining all initial variables. An adjusted odds ratio of 2.19 (95% confidence interval 1.62-2.95) was found for the relation between ethnic group and presence of OAG. The Hosmer and Lemeshow p value was 0.10, indicating an acceptable fit of the model.

Discussion

In this study, the overall prevalence of OAG was 2% and 3% in the University patients and the general ophthalmological practice patients respectively. The mean age of the patients was approximately 54 years. Prevalence was significantly higher in male and older patients. Those findings were consistent with the observations of most other clinic-based studies in black Africa. Such studies have noted prevalences ranging from 2-9% (11-19).

The prevalence of OAG is influenced by a number of factors. Age, sex and race (ethnicity) are among these factors. It has long been known that prevalence of OAG increases with age (1,6,20,21). In persons over 60 years an almost nine-fold higher prevalence was found compared with those under 40 years (21-24). This relation was confirmed by this study for all ethnic groups that were studied.

The relation between gender and prevalence of OAG varied among studies. In this study, men were more than twice as likely as women to have OAG (OR = 2.44; 95% Confidence Interval: 1.86-3.19). It is possible that the difference in this study results from older male people being more likely to have access to the ophthalmologist than older females.

Ethnicity (race) also had an influence on the prevalence of OAG. Several studies (1,6,20-22,24) showed that blacks have a higher glaucoma prevalence than whites. In this study based on black patients only, overall, Mongo ethnic group patients were found to have an increased prevalence of OAG compared to Kongo and other ethnic group patients.

Mongo ethnic group patients showed a twofold prevalence of OAG compared to Kongo and other ethnic group patients. This was confirmed after adjusting for age, sex and type of practice. This finding suggests that differences observed sometimes in glaucoma prevalence studies based on black patients could at least partly be explained by the ethnic origin of the patients.

Intraocular pressures and vertical cup/disc ratios in glaucoma patients were similar in the three ethnic groups in this study. These findings suggest that the difference in prevalence of OAG between Mongo, and Kongo and other ethnic groups could not be explained by the greater values of these two anatomic/physiologic conditions. Neither it is expected to result from earlier diagnosis in one of the ethnic groups, as could result from an easier access to ophtalmological care.

In this study, the overall prevalence of OAG was higher in the private practice than in the University practice and the distribution of OAG by vertical cup/disc ratio and by IOP differed between the two populations. This difference could be explained in part by the fact that in the University practice most cases were presented at a more advanced stage of disease.

Although it is impossible to exclude this totally, we have no reason to think that the level and type of care offered to Mongo or the access to health care provisions differed between the ethnic group. To minimize the possibility of selection bias, we did choose two different populations of patients: the first from an academic institution and the other from a general private ophthalmological practice. The relation between ethnic groups and prevalence of OAG was almost identical in both populations. However, further analyses including the examination of a population-based sample of Mongo and Kongo people that are recruted in their own region of origin using comprehensive examination techniqus are needed to refute or support our results.

Our data also must be reviewed with caution because the patients in this study consulted or were referred on clinical grounds. Also the measurements were based on clinical methods and no independent second

observation could be included. This may have resulted in selection and/or measurement bias. There is no reason however, to believe that this, if present, would have biased the relation between ethnic group and OAG in a selective way.

The reason for the difference observed in proportions of OAG between Mongo and other ethnic groups is uncertain. Could it be related to genetic or environmental differences between the populations? More detailed studies including electro-microscopic examination and adjustment for other co-variables as diet habits, cardiovascular factors, etc. have been started to elucidate these questions.

Despite these possible limitations, this study support the view that Mongo ethnic groups have a higher prevalence of OAG compared to other ethnic groups. Additional studies are needed to further define the role of ethnicity as a risk factor for glaucoma.

Résumé

But: Comparer les fréquences relatives du glaucome chronique simple parmi les sous-groupes ethniques (Mongo, Kongo et autres) chez les patients noirs au Congo

Méthodes: Une étude retrospective transversale des patients avec glaucome chronique simple dans une Institution Universitaire et dans une clinique d'ophtalmologie générale examinés entre 1991 et 1995. Les patients ont été groupés en fonction de leur sous-groupe ethnique.

Résultats: La proportion des patients avec glaucome chronique simple est significativement différente en fonction du sous-groupe ethnique entre les Mongo (5%), les Kongo (2%) et les autres (2%) ($p < 0.001$). Il n'existe pas de différence entre les sous-groupes ethniques quant à l'âge moyen (53 ans), la prédominance du sexe masculin (sex ratio, 2:1), la pression intraoculaire (31 mmHg) et le rapport cup/disc (0.8) au moment du diagnostic.

Conclusion: Le glaucome chronique simple semble être plus fréquent dans le sous-groupe ethnique Mongo que dans d'autres. D'autres études dans les populations représentatives peuvent être utiles.

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