Ethnic Characteristics of Eye Structure and Prevalence of Primary Glaucoma Separate Forms

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Abstract

According to WHO data glaucoma is rated as the second cause of blindness (13 % of cases) and hyposeeing in the world after cataract (47 %).

Racial accessory is the important factor influencing the prevalence of separate forms of glaucoma. Different races are subject to one or another form of glaucoma owing to the certain anatomic features of eyes. Prevalence of different forms of glaucoma is studied thoroughly at European ethnic group. Prevalence of primary open-angle glaucoma (POUG) among the European populations is higher, varying from 0. 4 to 4.1%. Among the Afro-Americans the high frequency rate of POUG is revealed, being six times higher in comparison with the Europeans. At the majority of Mongoloids owing to anatomic-physiological features of the visual organ closed-angle glaucoma (ZUG) is more widespread.

In the territory of Russia the prevalence of PG among the Mongoloid population is most studied at representatives of various ethnic groups living in the territory of Eastern Siberia.

The carried-out literary review revealed variability of incidence and prevalence of PG not only among various races, but also in each of them, and also showed the relevance of epidemiological surveys at various ethnic groups.

Keywords: epidemiological surveys, ethnic characteristic, closed-angle glaucoma, open-angle glaucoma.

Introduction

According to WHO data glaucoma is rated as the second cause of blindness (13 % of cases) and hyposeeing in the world after cataract (47 %) [12, 29]. According to H.A. Quigley (2006) a number of glaucoma patients will increase to 79,6 million by 2020 all over the world, 74 % of them referring to open-angle glaucoma (OAG). Natives of Asia with glaucoma will make up 47 % and 87 % with close-angle glaucoma (CAG). The glaucoma as the cause of bilaterial blindness by 2020 will comprise 5,9 million with the open-angle form and 5,3 million with the close-angle one. [43].

Ethnicity is considered to be an important factor influencing on prevalence of separate glaucoma forms [12, 43]. Three common ethnic groups are as follows: the European (Euroasian, Caucasian), the Mongolian (Asian-American) and the Equatorial (Negroid – Australian), which are divided into subgroups consequently. Now, according to some scientists, there are 34-40 races noted. Ethnic features are hereditable and adaptive to living conditions.

All races are equivalent in biological and psychological relations. Genetic distinctions do not mean the superiority of any race, ethnic or other group. On the contrary, they underline the evolutionary value of the variety which has allowed mankind not only to develop all climatic zones on the Earth, but also to adapt to those considerable changes of the environment resulted from human activity [2].

High frequency rate of glaucoma and its position in the structure of blindness and hyposeeing induce ophthalmologists of all continents to conduct epidemiological researches and studies concerning to ethnic characteristics of the disease. Different races are subject to either one or another form of glaucoma owing to certain anatomic ocular characteristics [20, 48].

The prevalence of different forms of glaucoma among the Eurasian ethnic group has been studied thoroughly. The primary open-angle glaucoma among European populations varies from 0,4 to 4,1 % [10]. According to M.W. Tuck and coauthors POAG is noted most frequently in Great Britain, among the European populations its prevalence makes 1,2 % [52]. S. Pardhan and coauthors carried out the comparative analysis of blindness as the result of glaucoma among the Europeans and natives of Southern Asia in Great Britain. In age group the percentage ratio has amounted to 29,3% at patients of 65 years and older among the Europeans, while 17,4 % among the Asians correspondingly [34]. As the result of the large-scale epidemiological research in the Netherlands (The Rotterdam Study) POAG prevalence has been established among Europeans amounting 1,1 % as a whole, increasing from 0,2 % in age group of 55-59 years to 3,3 % among persons at the age of 85-89 years. POAG prevalence was noted at a higher level almost three times at men than at women [49]. F. Topouzis and coauthors during the epidemiological research The Thessaloniki Eye Study (Greece) have revealed that prevalence OAG has rated from 3,8 % to 5,5 % [40]. The same data were revealed by epidemiological researchers of Spain as well confirming that the prevalence POAG in the European populations was higher among men (2,4 %) as compared with women (1,7 %), making 2,1 % in total and increasing with the years [35]. A. Ringvold in the literary review devoted to questions of the glaucoma epidemiology in the countries of northern Europe notices that OAG is observed more often in Finland, the central Sweden, Norway and Iceland in comparison with Southern Sweden and Denmark that can be somewhat connected with a low rate of pseudoexfoliative syndrome (PES) in southern regions [46].

American ophthalmologists reveal essential distinctions in prevalence and disease of glaucoma among Europeans and Negro races [44]. J.M. Tielsch with coauthors have conducted the large-scale research The Baltimore Eye Survey and revealed the high frequency rate of POAG among the Afro-Americans which is six times higher in comparison with Europeans, affecting people of younger ages (manifested at 10 year-old younger ones) with quick progression. The Afro-Americans are considered to be less sensitive to preparations of intraocular pressure reduction, followed in most cases by insufficient hypotensive efficiency after surgical treatment [41]. Among the Latin Americans OAG prevalence is higher than at the Europeans as well and comparable to its frequency among the Negro race [28].

The Mongolian or Asian-American huge race is one of the most numerous races in the world. It covers about 50 % of all population in the globe. The Mongolian race is divided into some small races: the North Asian, Arctic, South Asian, Far Eastern and American races.

Owing to anatomic-physiological features of the visual organ the close-angle glaucoma was mostly extended among the Mongolians [22, 25]. At patients with CAG or with risk of its development the following anatomic features are typical in most cases: reduction of cornea curvature diameter and radius [31, 33]; smaller anterior chamber (AC) and its volume reduction [31, 32]; increase of lens thickness and curvature [30, 31]; more anterior position of the crystalline lens [30,31]; increase of lens thickness in relation to length of optical axis [27]; reduction of axial length [31, 32].

Among representatives of the Mongolian races there is a significant ethnic variety, and these distinctions are traced in prevalence of various forms of primary glaucoma (PG). According to N.A. Quigley with coauthors CAG is mostly extended among inhabitants of China and Mongolia, and also indigenous population of the North America and the island Greenland (Eskimos) [42]. In the course of population's surveys concerning the Eskimos of northwest Alaska it has been revealed that PCAG amounted to 90,9 % of all glaucoma cases. The women have undergone the illness almost four times more frequently than the men [47]. The research carried out in China has revealed that 9,4 million senior people of 40 years and older have glaucoma optic nerve defeat, 5,2 millions of them (55 %) have one eye blindness and 1,7 million

people (18 %) are blind on both eyes. PCAG is the cause of bilateral blindness in 91 % of cases [26].

However, in the epidemiological studies carried out among various ethnic groups in Singapore the tendency of prevalence POAG is noted. According to P.J. Foster with coauthors POAG and PCAG have rated 1,78 and 1,13 % accordingly among ethnic Chinese of Singapore [50].

The epidemiological studies carried out in Japan have revealed a PCAG lower level in comparison with other Asian populations. According to Y. Shiose with coauthors PCAG frequency rate has summed 0,34 %, and the number of cases of low pressure glaucoma (LPG) almost four times exceeded the number of POAG cases with high IOP 2,04 % and 0,58 % accordingly [24]. The similar showings with LPG higher rate noted by H. Katsushima and coauthors revealed that frequency of LPG, POAG and PCAG among the investigated contingent has amounted accordingly 2,6, 0,59 and 0,47 % [23].

The prevalence of PCAG among Europeans is much lower in comparison with Asians, being 0,04 % according to The Beaver Dam Eye Study (USA), 0,06 % - The Melbourne Visual Impairment Project (Australia), 0,09 % - Roscommon (Ireland), 0,17 % - Bedford glaucoma survey (Great Britain), 0,27 % - The Blue Mountains Eye Study (Australia), 0,4 % - The Baltimore Eye Survey (USA), 0,6 % - The Egna-Neumarkt Study (Italy) [21, 36, 37, 38, 39, 45, 51].

There were several tentatives for studying ethnic aspects of glaucoma in the period of the USSR. In territory of the former USSR the disease of glaucoma amounted from 0,9 to 3,5 %, at the same time indices within one republic could range from 0,2 to 6 % [14]. The prevalence PCAG in the literature is noted among the majority of patients in the Central Asia (Turkmen, Kazakhstan, Tajikistan, Kirghizia and Uzbekistan). In Uzbekistan the disease of PG among the population of 40 years and older reached 1,5-2,5 %. OAG was noted at 20,1 %, CAG - in 79,9 %. CAG prevailed among representatives of Uzbek nationality [7]. The natives of Turkmenistan had PCAG more often (59,8 %), than POAG (31,5 %) [17]. M.K.Dikambaeva with coauthors revealed the prevalence of CAG in Kirghizia at women (80,6 %), while it being diagnosed at 20,9 % Kirghiz men [5]. The PG large-scale epidemiological research in Tazhdikistan presented by Akhrorova Z.D. has revealed a mosaic structure of the disease and PG prevalence in various geographical zones of republic [1].

In Russia, among not numerous epidemiological studies, the most part is devoted to studying of the illness, its frequency rate and physical inability among the European race. POAG frequency rate is becoming higher with the years. If 40-45 and 50-60 year-old people are numbering 0,1 % and 1,5-2 % of the population, those of 75 and older amount to 10 % [15]. For today in most regions of Russia glaucoma is the main reason of primary physical inability owing to eye diseases, rating from 23 to 57 % of all cases of physical inability [6, 12, 16]. In the territory of Russia PG prevalence among the Mongolian population is studied more thoroughly at representatives of various ethnic groups living in the territory of Eastern Siberia (inhabitants of Altai, Khakases, Tuvinians).

Genetically modern Altaians represent the Mongolian group, possessing nearby the European characteristics. According to A.V. Kolbasko the glaucoma in Gorniy Altai has been revealed at 3,3 per 1000 population (3,3 ‰). It is noticed that among Altaians the glaucoma is manifested earlier than among the Europeans, therefore it is necessary to conduct prophylaxis for early diagnostics of the glaucoma among the inhabitants of Mountain Altai since 30 years [9].

According to V. P. Puzyreva with coauthors the Tuva population is genetically closer to the Altaians, the Evens, the Evenks and the Jukagirs than to the Mongols, the Chukchis and inhabitants of Tibet as well. [3]. These showings reflected to clinical-epidemiological features of the glaucoma among the natives of the republic Tyva, the latter ones being samples in Tkachenko's survey. It was revealed that the number of natives was 63,1 % of the total number

suffering with OAG, and 36,9 % referring to the European group accordingly. As for CAG form, there were 88,1 % natives and only 11,9 % Europeans. POAG relative density among the native adult population was lower than among the arrived ones (75,4 % vs 91,3 %). It is to be noted, that POAG at natives of the Republic Tyva proceeded in a narrow-angle form - a narrow profile of iridocorneal angle (ICA) , it being diagnosed at 58,8 % surveyed. This parameter was noted 7,3 times more frequently than at Europeans [18].

Karamchakova L.A. studying the population of Khakassia has revealed that POAG has amounted to 89,3-93,5 % from total number of glaucoma, while PCAG and CG being only 1,3-2,5 % and 1,3-2,9 % accordingly. The relative density of the Khakases with POAG has ranged 23,5-23,8 %, and 76,2-76,3 % at Europeans, that is caused by the big relative density of the European population. The natives comprised about 1/3 of the total number of patients with PCAG, the other 2/3 refer to the European group. Among patients with mixed form the Khakases have made up 37-47 %, the Europeans being 53-63 % accordingly [8]. Thus, in spite of the fact that the CAG form is traditionally considered to be prevailing at the Mongolian group, OAG form with narrow (including beakshaped) and mid-latitudial ICA was extended among the Tuvinians and the Khakases, this characteristis identifying from other Mongolian races [11] .

The Yakuts, from Evenk language 'yakolsy', the self-name 'sakha', are one of the most numerous natives of Siberia, comprising the majority of indigenous population of the Republic Sakha. The physical appearance of Yakuts is characterized by Central Asian anthropological type of the Mongolian race. The ethnic genesis of Yakuts has come to the end to the beginning of XVI century, when they underwent the absorption by southern Baikal Turkic immigrants. The immigrants were of the mixed Turkic-Mongolian origin, while the local tribes were presented as the Tungus Evens, the Evenks, the Jukagirs and other relative paleoasian tribes representing the ancient population of Yakutia [4]. The controversary data of the numerous surveys concerning to PG prevalence among the non-homogenous Mongolian races and unclear heterogeneous origin of Yakuts served as the stimulus for studying the glaucoma epidemiology in RS (Y). As the result of the epidemiological studies of the natives RS(Y), PG samples were revealed: 1) a higher level of general glaucoma in the republic (1247,2 per 100 thousand adult population) which exceeds the data all over the Russian Federation on 48,5 % [19]; 2) POAG high frequency rate (64,5 %) with typical narrow «beakshaped» profile of anterior chamber angle (ACA) (57 %), with high exogenic pigmentation of drainage system; 3) short front-back eyes (FBS) less than 23,0 mm; 4) relatively smaller linear (except thickness of iris) ocular parameters at all investigated PCAG patients at ultrasonic biomicroscopy (UBM) in comparison with emmetrope group without glaucoma [13]; 5) among PCAG indigenous people 65 % of cases with relatively pupillary block in ACA closing, and 35 % with flat iris syndrome.

This literary review carried out has revealed the variability of PG disease and its prevalence not only among various ethnic groups, but also in each of them, as well as has shown the necessity of epidemiological surveys among various ethnic groups.

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