

Analysis of Current Trends in the Study of Glaucoma Based on a Review of Scientific Publications

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Abstract

Aim: Analysis of the modern publications about glaucoma, its etiology, pathogenesis, clinical course, problems of diagnosis and treatment, taking into account the above recommendations and based on the study of publications over the past 50 years.

Materials and Methods: We analyzed publications on glaucoma of the medical platform PubMed for 50 years (1970 - 2019), publications of the "Ophthalmological Journal" and "American Journal of Ophthalmology" for the same period, and data from popular ophthalmological journals available in the free electronic access "National Journal of Glaucoma", and "British Journal of Ophthalmology" over the past 10 years (2010 - 2019).

Results: Analysis of publications on glaucoma has shown that for the period from 1970 to the present, there has been a constant increase in interest in the study of all aspects of this disease. For the period 2010 - 2019 increased interest in an individualized approach to the study and treatment of glaucoma. The primary areas of research both in domestic and foreign literature during this period were the study of the theoretical foundations of the disease (33.3% and 26.2%, respectively) and surgical methods of treating glaucoma (20.7% and 17.9%, respectively). At the same time, interest in the surgical treatment of glaucoma from 1970 to the present time prevails in the domestic scientific literature. But its growth rate declined by 2019. In the 1980s, ophthalmologists were most interested in studying the functional status of glaucoma using automated perimetry data; since 2000, the area of interest has shifted towards studying the morphometric parameters of the optic nerve head using optical coherence tomography.

Conclusion: The head directions in the study of glaucoma are the same in Russia and abroad - these are the problems of studying the theoretical aspects of the disease (etiology, pathogenesis) and the improvement of surgical methods of treatment. The data obtained reveal a growing interest in an individual approach to the study of glaucoma. The number of publications on conservative treatment of glaucoma has increased in Russia since 2010. At present, the most promising diagnostic direction is the study of the morphometric parameters of the optic nerve head in glaucoma.

Keywords: Primary Glaucoma; Scientific Publications; Automated Perimetry; Heidelberg Retinal Tomography; Optical Coherence Tomography; Glaucoma Treatment

Introduction

Glaucoma occupies one of the leading places among the topical problems of ophthalmology. A significant number of modern publications are devoted to the study of various aspects of this multifactorial disease, and ophthalmologists receive the main information on glaucoma research trends, despite the widespread development of information internet portals, by reading specialized medical literature.

Statistically, physicians from USA spend 2 - 5 hours per week reading periodicals and receive up to 12 journals (paid and free). In Russia, 38% of physicians devote up to 5 hours per week to reading specialized literature and 37% of physicians spend more than 5 hours per week [1].

For a subjective purpose, specialized literature is read in order to:

1. To keep abreast of developments in their professional field;
2. To know how experienced specialists work with patients;
3. Correctly interpret modern diagnostic methods;
4. Know the clinical features and course of diseases;
5. Understand the etiology and pathogenesis of diseases;
6. Distinguish useful treatment from useless and harmful intervention;
7. Understand the messages of necessity, usefulness, profitability and economy of treatment and prevention methods;
8. Impress other specialists.

The purposes of writing the research paper itself, as the analysis shows, can be:

1. To determine the diagnostic value of the method under study;
2. To determine the efficacy and safety of the drug;
3. Comparison of different treatment regimens;
4. Review of the literature;
5. Meta-analysis.

Purpose of the Study

Analysis of modern literature on trends in the study of glaucoma, its etiology, pathogenesis, clinical course, diagnostic and treatment problems, taking into account the recommendations listed above and based on the study of publications over the past 50 years.

Materials and Methods

In order to improve the perception of information in any scientific literature, a semantic division into sections devoted to different branches of knowledge is traditionally accepted. In medical journals, as a rule, there are sections devoted to clinical research, experi-

mental studies, practical health care, etc. Publications on glaucoma, its etiology, pathogenesis, clinical course, diagnostic and treatment problems are also conditionally subdivided according to this or that journal differentiation.

To analyze trends in glaucoma research, this paper reviews domestic and foreign publications over a long period of time. We analyzed data from the English-language medical platform PubMed for 50 years (1970 - 2019), publications from the “*Journal of Ophthalmology*” (Russia) and the “*American Journal of Ophthalmology*” for the same period, and data from popular ophthalmology journals available in the free electronic access “*National Journal of Glaucoma*” and the “*British Journal of Ophthalmology*” for the past 10 years (2010 - 2019).

The head keyword to search for relevant publications in the PubMed service was the name of the disease under study: “Glaucoma”.

To study the publications in the “*National Journal of Glaucoma*” and the “*British Journal of Ophthalmology*” over the past decade (2010 - 2019), we proposed to divide the articles according to a number of conditional characteristics that were consistent with the subjective goals of studying the specialized literature. The aim of this division was to identify and compare the main trends in the study of glaucoma in Russia and abroad. Nine groups of articles are distinguished, which are presented in the table 1.

The total number of articles on glaucoma in Russian and foreign literature was 514. Of these, 213 articles were published in the Russian journal, and 301 articles were published in the foreign journal. The study period of the publications was 10 years.

Results and Discussion

The main sections of publications in the PubMed database are as follows: Books and Documents, Clinical Trial, Meta-Analysis, Randomized Controlled Trial, Review, and Systematic Review [3]. The overall trend for all sections for the time period from 1970 to 2019 inclusive is shown in figure 1.

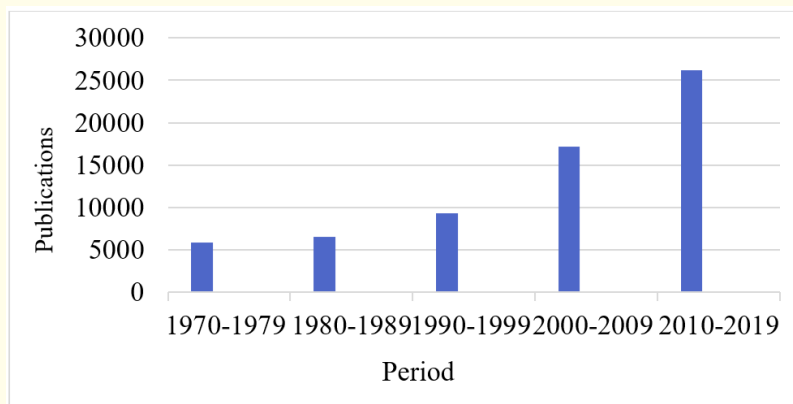


Figure 1: Overall trend in the studying glaucoma in 1970 - 2019.

Figure 2 and 3 show trends in glaucoma research over the same time period by subject area.

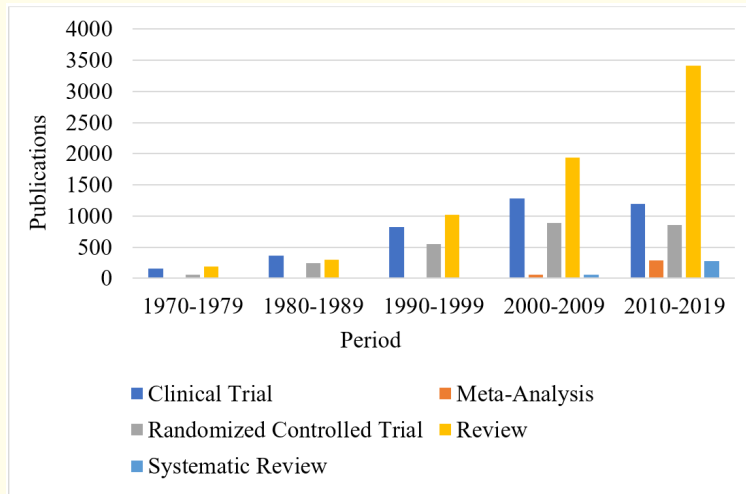


Figure 2: Trends in studying glaucoma in 1970-2019 (Clinical Trial, meta-analysis, randomized controlled trial, review, and systematic review).

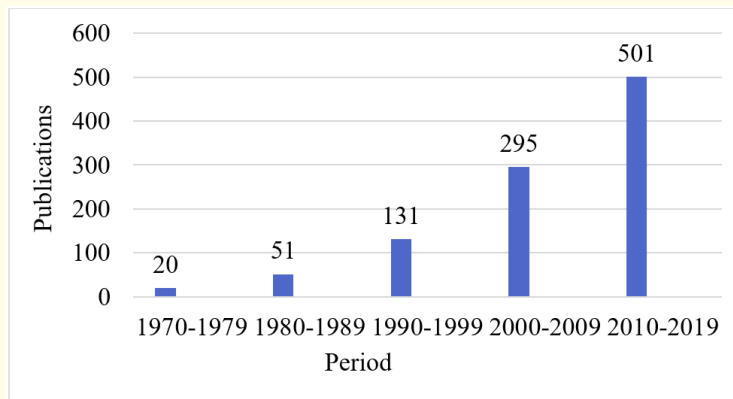


Figure 3: The trend in the study of glaucoma from 1970 to 2019, taking into account the individual approach.

Thematic sections are shown in figure 2 and 3. The Books and Documents section is excluded because it usually contains information about publications that duplicate scientific publications from an earlier period of time.

It is noteworthy that the statistical data for a number of sections are not from 1970, but from a later period. Thus, statistical information on the Clinical Trial section has been presented since 1975, on the Meta-Analysis section since 1993, on the Randomized Controlled Trial and Review sections since 1975, and on the Systematic Review section since 1999. This is related to the improvement of the database and consistent formation of the relevant conceptual search fields of the PubMed service.

Analysis of the graphs in figure 2 and 3 shows a steady increase in glaucoma research publications since 1970. The peak values for the Clinical Trial and Randomized Controlled Trial sections are from 2000 to 2009. For the other sections, the number of publications continues to grow.

We hypothesized that the slight decrease in the number of publications under Clinical Trial and Randomized Controlled Trial sections over the period 2010-2019 was due to a redistribution of interest from collective (as practiced in clinical trials) to an individual (personalized) approach to glaucoma detection and treatment [4-6], and we analyzed data from the PubMed service for this combination of features.

As shown in figure 3, there has been a significant increase in the number of publications on individualized glaucoma research specifically for the period from 2010 to 2019.

Priority directions in glaucoma research were investigated over a shorter time period (2010 - 2019) with examples from the Russian “National Journal of Glaucoma”, whose main focus is the study of this disease, and the “British Journal of Ophthalmology”.

The distribution of articles from these journals into “conditional” groups is shown in table 1.

Groups	1	2	3	4	5	6	7	8	9	Total
Russian journal, %	33,3	9,9	20,7	15,9	0,5	4,2	0,5	8,4	6,6	100
Foreign journal, %	26,2	3,9	17,9	9	4	12,3	3	17,7	6	100

Table 1: Paper distribution by groups (%).

1. Theoretical articles - The conventional name for articles that study various aspects of the etiology, pathogenesis, and course of glaucoma, without touching their practical implementation at the present time;
2. Practical articles - The conventional name for articles devoted to the study and support of the practice of ophthalmologists;
3. Surgical direction - Materials devoted to the study of current trends in glaucoma surgery;
4. Therapeutic direction - Materials devoted to the study of current trends in the conservative treatment of glaucoma;
5. Pediatric direction - Articles devoted to the study of glaucoma in children and adolescents;
6. Socio-economic direction - Articles examining the lifestyles of people with glaucoma, their income and expenses, and social assistance issues;
7. Informatics and medicine - Articles on the implementation of computer technology and software in the detection and monitoring of patients with glaucoma;
8. Diagnostic direction - Study of glaucoma diagnostic methods used in daily practice;
9. Somatics and glaucoma - Articles devoted to the study of the relationship between concomitant somatic pathology and glaucoma.

Based on the data obtained, several priority directions in the study of glaucoma have been identified. In both Russian and foreign journals, leading positions were taken by articles from the conditional group “Theoretical Articles” (33.3% and 26.2%, respectively). This is followed by publications devoted to the surgical treatment of glaucoma, the conditional group “Surgical direction” (20.7% and 17.9%, respectively).

Further positions in Russian and foreign scientific literature were distributed in different ways. A significant place in Russian publications of the last decade is occupied by topics of conservative treatment of glaucoma (group “Therapeutic direction”, 15.9%), topics devoted to the daily practice of ophthalmologists (group “Practical direction”, 9.9%) and the study of modern diagnostic trends (group “Diagnostic direction”, 8.4%). While foreign publications pay more attention to the problems of glaucoma diagnostics (group “Diagnostic

direction”, 17.7%), the study of socio-economic aspects in the treatment of glaucoma (group “Socio-economic direction”, 12.3%) and conservative treatment of glaucoma (group “Therapeutic direction”, 9%). In our opinion, 9%, respectively).

We decided to focus on publications of surgical and therapeutic directions in the treatment of glaucoma, since there are significant differences between domestic and foreign scientific works on this topic (15.9% and 9%, respectively) (Figure 4 and 5).

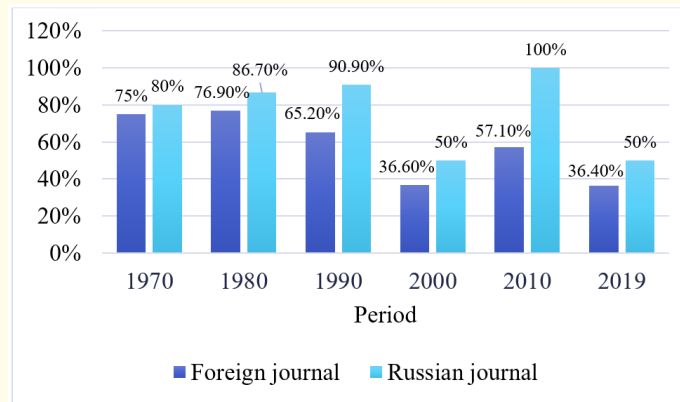


Figure 4: Surgical management in studying glaucoma beginning from 1970.

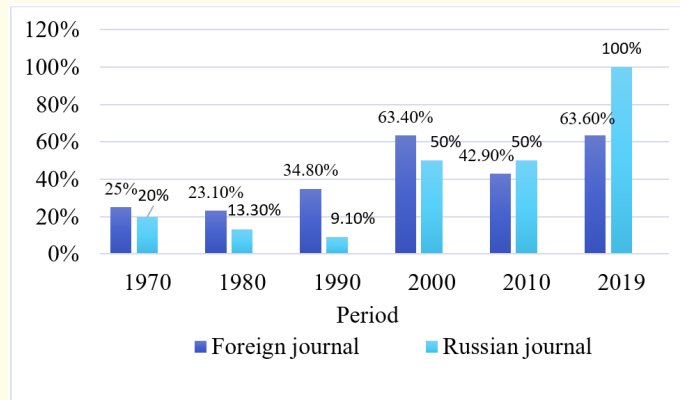


Figure 5: Therapeutic management in studying glaucoma beginning from 1970.

As shown in figure 4, interest in the surgical treatment of glaucoma has dominated the domestic scientific literature from 1970 to the present, but the rate of growth of this interest has declined by 2019. According to figure 5, interest in the therapeutic treatment of glaucoma predominated in foreign scientific publications until 2000. In the last decade, however, there has been a significant increase in the number of publications devoted to the conservative treatment of this disease in domestic journals.

The growth of interest in glaucoma based on the study of publications of the PubMed service begins in the 90s. Historically, this coincides with the ubiquity and study of automated perimetry techniques [7]. The first automated perimeter Octopus-201 was created in 1974 in Switzerland by INTERZEAG. In 1985 A. Heijl and C. Krakau developed software for another automated perimeter, the Humphrey Visual Field Analyzer. Average terms of practical implementation of any new invention are from 5 to 10 years [8,9]. Thus, the beginning of active clinical research on automated perimeters roughly coincides with the early 90s and the growth of requests for relevant scientific literature in the PubMed service.

The history of optical coherence tomography begins in the mid-90s. It was then that the first laboratory OCT installations were created in Russia, at the Institute of Applied Physics of the Russian Academy of Sciences, thanks to advances in fiber-optic broadband interferometry and femtosecond optics. In 1991, a group of researchers from the Massachusetts Institute of Technology, led by Fujimoto J.G., first demonstrated the possibility of obtaining sections of the retina using this method of optical coherence tomography [10-12].

The history of the development and implementation of Heidelberg retinal tomography in practice begins in 1986, when Heidelberg Engineering (Germany) introduced the first Heidelberg Retina Tomograph (HRT) laser scanning system to the world market. This also predetermined the direction of scientific research and, accordingly, an increase in the number of publications on the study of the morphometric parameters of the optic nerve head.

Figure 6 shows the evolution of interest in the study of glaucoma according to the PubMed service, taking into account the emergence of new diagnostic technologies (in logarithms).

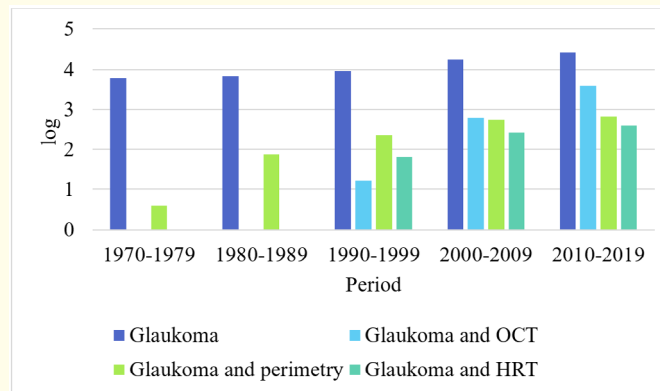


Figure 6: Trends in the studying in 1970 - 2019, given modern technologies (log).

As can be seen from figure 6, since 1970, ophthalmologists were mostly interested in studying the functional status of glaucoma using automated perimetry data, but with the introduction of new technologies, the sphere of interest shifted to the study of morphometric parameters of the optic nerve head. Currently, interest in studies of anatomical structures using OCT prevails.

The information presented in the article about the main trends in the study of glaucoma is rather conventional: there is no division into glaucoma forms and stages, no combined inquiries have been created and investigated, and many others. However, the above graphs demonstrate the correlation between science and technical progress, display the preference of contemporary ophthalmologists for the study of morphometric parameters in glaucoma, and note the transformation of interest in glaucoma treatment. This is what defines current trends in glaucoma research.

Conclusion

1. The main directions for the study of glaucoma are the same in Russia and abroad - these are the problems of studying the theoretical aspects of the disease (etiology, pathogenesis) and improving surgical methods of treatment;
2. A slight decrease in inquiries for the period 2010-2019 in the sections Clinical Trial and Randomized Controlled Trial, possibly due to the growth of interest in the individual approach to the study of glaucoma;
3. In the domestic medical literature since 1970, interest in surgical treatment of glaucoma has dominated; since 2010, the number of publications devoted to conservative treatment of glaucoma has increased, which seems to be related to the greater availability of hypotensive drugs in all regions of the Russian Federation;
4. Based on the study of the publications of the PubMed service, the study of morphometric parameters of the optic nerve disc in glaucoma seems to be the most promising diagnostic direction.

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