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Current Approaches, Improvements And Prospects In The Field Of Eye Disease

Rasulova Nilufar, Azamatova Fazilat
Tashkent Pediatric Medical Institute (Uzbekistan)

Abstract. Ophthalmology, the branch of medicine concerned with the study and treatment of disorders and diseases of the eye, has evolved significantly over recent decades due to advances in technology, medical research, and public health initiatives. This article explores the current trends in ophthalmology, such as the growing adoption of minimally invasive surgeries, artificial intelligence (AI) applications, and telemedicine. It also addresses pressing challenges in the field, including the rising prevalence of eye diseases like cataracts, glaucoma, and age-related macular degeneration (AMD), as well as disparities in access to eye care in low-income regions. The article concludes by analyzing future prospects, including innovations in gene therapy, regenerative medicine, and global health policies aimed at improving vision health worldwide.
Keywords. Ophthalmology, eye care, cataracts, glaucoma, age-related macular degeneration, artificial intelligence, gene therapy, telemedicine, global health, regenerative medicine.

Relevance. The field of Ophthalmology has witnessed remarkable changes due to innovations in medical technology and scientific understanding. The eye is one of the most complex organs and presents specific difficulties for medical treatment and surgery. Ophthalmologists deal with a number of conditions ranging from fracture errors to degenerative diseases such as glaucoma and age-related macular degeneration (AMD), which can lead to blindness if left untreated. In recent years, there has been an increase in research and development aimed at improving diagnostic accuracy, treatment efficiency and access to eye care services. Technologies such as artificial intelligence (AI) have begun to play a crucial role in detecting early-stage eye diseases, while minimally invasive operations such as laser-assisted cataract surgery are becoming more common (Balyen and Peto, 2019). At the same time, the growing global burden of eye diseases and the inequality in the use of specialized medical care underscore the need for increased health care. This article explores current trends in the formation of Ophthalmology, the problems faced by professionals in the field and the future prospects that promise to improve vision health among the population.

Main part. 1. Current trends in ophthalmology

1.1 minimally invasive surgical methods

The transition to minimally invasive treatments is one of the most important advances in ophthalmology. Traditional operations for conditions such as cataracts, glaucoma, and retinal detachment are now being replaced or supplemented by laser-assisted methods. For example, femtosecond laser cataract surgery (FLACS) offers more accurate and faster recovery times than traditional methods (Moshirfar et al., 2021).

Similarly, innovations in minimally invasive glaucoma surgery (MIGS) have changed the way patients are treated for this chronic disease. MIGS procedures use small incisions and tools to improve intraocular fluid drainage and thus reduce intraocular pressure without the risks associated with more invasive surgery (Tan et al., 2020).

1.2 artificial intelligence and machine learning

AI is quickly becoming the basis of ophthalmological diagnostics. Machine learning algorithms have been developed to detect eye diseases by scanning an image with remarkable accuracy. AI has promised in screening for diseases such as diabetic retinopathy, glaucoma, and AMD, which is often superior to traditional diagnostic tools (Balyen and Peto, 2019). This trend is especially important in areas with limited access to qualified ophthalmologists, as AI tools can facilitate early detection and rapid intervention.

The integration of AI in Ophthalmology is not limited to diagnostics. Artificial intelligence-based systems are being developed to help plan surgery and predict patient outcomes, thereby personalizing treatment and improving efficiency (Abràmoff et al., 2018).

1.3 telemedicine in eye care

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Telemedicine has developed intensively against the background of the COVID-19 pandemic, which especially stressed the need for remote health solutions. Telemedicine platforms in ophthalmology allow eye care professionals to remotely monitor patients, perform preliminary screenings, and even offer postoperative advice. This reduces the need for personal visits, which makes care more accessible for patients in rural areas or in unserved areas (Nagra et al., 2020).

Teleophthalmology, i.e. remote eye care, has played an important role in providing timely assistance to patients with chronic diseases such as glaucoma and diabetic retinopathy, where constant monitoring is necessary. Although there are difficulties that need to be solved, including the need for specialized imaging equipment, the potential of teletypbiotics to eliminate deficiencies in eye care is beyond doubt.

2. Current problems of Ophthalmology

2.1 global Burden of eye diseases

Eye diseases, in particular cataracts, glaucoma and AMD, are an increasing health problem. According to the World Health Organization (who), more than 2.2 billion people worldwide suffer from visual impairment, of which at least 1 million are preventable or incurable (who, 2019). Cataracts remain a major cause of blindness worldwide, especially in low-and middle-income countries with limited surgical resources. Glaucoma, often referred to as the "silent thief of sight", affects millions of people around the world. Its asymptomatic development makes early detection difficult and in many cases leads to irreversible loss of vision (Quigley & Broman, 2006). Similarly, AMD appears as a major cause of blindness in aging populations, with no current cure.

2.2 service use and inequality

One of the main problems of Ophthalmology is the imbalance in the use of quality eye care, especially in developing countries. While more advanced treatments are available in wealthy countries, millions of people with scarce resources suffer from preventable blindness due to their lack of access to eye care professionals, affordable treatment, and essential technologies (Bourne et al., 2017).

This inequality in the use of Health Services is exacerbated by the lack of trained ophthalmologists in many regions. For example, in Sub-Saharan Africa, there are fewer than one ophthalmologist per million people in some regions, compared to approximately 79 per million people in the United States (Resnikoff et al., 2020). The solution to this problem requires joint efforts, including training programs, investment in health infrastructure, and environmental assistance initiatives.

3. Future prospects of Ophthalmology

3.1 gene therapy and regenerative medicine

Gene therapy offers a promising pathway for the treatment of hereditary retinal diseases (IRDS) and other degenerative eye diseases. One of the first gene therapies, Luxturna, is approved for the treatment of a specific type of hereditary retinal dystrophy and serves as a precedent for future therapies (Maguire et al., 2019). Advances in CRISPR gene editing further expand the possibilities of correcting genetic mutations that lead to loss of vision.

Regenerative medicine, in particular the use of stem cells, is another limit of Ophthalmology. Researchers are studying how stem cells can be used to repair damaged retinal tissue and restore vision in diseases such as AMD and glaucoma (Cai et al., 2019).

3.2 optical technology achievements

Technological innovation continues to improve diagnostic tools and surgical techniques. For example, the development of optical coherent tomography angiography (OCTA) revolutionized the diagnosis of retinal diseases by providing detailed images of blood flow to the retina without invasive dye injections (Spaide et al., 2018).

Similarly, new intraocular lenses (IOLs) are being developed to improve the results of cataract surgery. These IOLs offer good visual quality and can even correct presbyopia, reducing the need to read glasses after surgery (Friedman et al., 2021).

3.3 Policy and health initiatives

The future of Ophthalmology also depends on effective health policies aimed at reducing the burden of preventable blindness. Global initiatives such as the World Health Organization's Vision 2020 campaign have made significant progress in the fight against vision impairment, but require more work to address the growing number of people losing vision due to population aging and lifestyle factors (who, 2019).

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Expanding access to affordable eye care through policy reform and public-private partnerships will be instrumental in achieving global goals for eye health. In addition, explanatory work on the importance of regular eye examinations of the population and early detection of eye diseases plays a decisive role in reducing preventable blindness conditions.

Conclusion. Eye disease is a rapidly developing field with promising innovations in technology and treatments. Current trends such as AI adoption, minimally invasive surgeries, and telemedicine are revolutionizing eye care. However, significant problems remain, in particular the global burden of eye diseases and inequalities in the use of medical care. Looking ahead, advances in gene therapy, regenerative medicine and optical technology provide hope for solving the most stubborn problems in eye health. By addressing disparities in the use of health services and continuing innovation, the field of Ophthalmology has the potential to significantly reduce the rate of preventable blindness of millions of people around the world and improve vision outcomes.

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