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Is Surgery the Only Way to Treat Cataracts

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Abstract

Cataract surgery is the most common elective procedure performed globally. The complications associated with cataract surgeries can cause severe adverse outcomes such as partial or total blindness. There is a need to pay close attention to whether surgery is the sole means of treating cataracts. Research on drugs for cataract prevention and treatment has advanced, however, ophthalmologists are still waiting for a definitive pharmacological approach to the treatment of cataracts. Even with many significant findings on the use of specific drugs as a solution for cataracts, there is still much to learn about cataract reversal. It is anticipated that the future of cataract medications will have new advances.

Keywords: cataracts; surgery; complications; pharmacological approach; treatment

Introduction

With more than 20 million procedures done each year, cataract surgery is the most common elective procedure performed globally (Han, Zhang et al. 2023). The most common cause of blindness worldwide is still cataract surgery as reported by the recent Global Burden of Disease survey (Pesudovs, Lansingh et al. 2021). To address cataract blindness in the aging population, an increasing number of cataract procedures are being performed in the interim. Surgical rates for cataracts are determined by counting the number of surgeries per million people in a given year (Rossi, Romano et al. 2021). This is the most significant public health metric used to evaluate the availability of cataract services (Rossi, Romano et al. 2021). The goal of maximizing the benefits that patients may receive from cataract surgery is receiving increased attention in tandem with a number of significant advancements that have occurred over the past few decades, such as the development of newer intraocular lens and calculation formulas, as well as the micro-incision cataract surgical technique (Grzybowski and Kanclerz 2020).

To achieve universal health coverage, the quality of care is just as important as accessibility to healthcare services (Wang, Mathur et al. 2020). Even though cataract surgery is one of the most economical medical procedures in comparison to other surgical procedures (Cicinelli, Buchan et al. 2023), the complications are worse and can develop poor visual results that result from surgical complications, ocular comorbidities, or insufficient optical correction (Han, Zhang et al. 2023). A valuable metric that can be used to gauge the effectiveness of cataract surgery and subsequent care is postoperative visual acuity (VA) (Khoramnia, Auffarth et al. 2022). According to the Global Initiative for the Elimination of Avoidable Blindness, there should be a high success rate for VA and better quality of life following cataract surgery (Organization 2000). Thus, knowing the current real-world visual outcomes of cataract surgery is essential for developing future methods for managing cataracts and serving as a valuable resource for decision-makers and ophthalmologists.

Current Situation

There is a need to pay close attention to whether surgery is the sole means of treating cataracts, and whether surgery is enough to correct cataracts, negating the need for additional treatments.

One ophthalmologist can perform over 2000 cataract procedures annually if certain requirements are met, such as having enough support staff, ideal infrastructure, and patients who can afford and are willing to pay for them (Chen, Xu et al. 2021). The global cataract surgery rate is 1406 per one million population annually (Chen, Xu et al. 2021). But in some African regions, the rate is 488 per one million population, one-third of the global average and a tenth of what it is in high-income nations (Chen, Xu

et al. 2021). The number of cataract surgeries required to prevent avoidable cataract blindness in the aging population is estimated to be only 500 after accounting for the age distribution and regional variations in the blindness rate (Pesudovs, Lansingh et al. 2021). Moreover, the complications associated with cataract surgeries can cause severe adverse outcomes such as partial or total blindness (Han, Zhang et al. 2023). Nickey et al notably report increased complications after the intermission of cataract surgery for two months during the COVID-19 lockdown (Hulsmans, Nuijts et al. 2023). Therefore, there is a time to look beyond surgery as the only method of treating cataracts.

Complications Associated with Surgery

Ruptures of the posterior capsule are the most frequent intraoperative complication in cataract surgery, with an incidence of 0.5% to 5.2% worldwide (Ivić 2021). Posterior capsule rupture also raises the risk of other complications such as retinal detachment surgery (15–18 times) and endophthalmitis (4.22–9.49 times) (Chen, Xu et al. 2021). Clinical cystoid macular edema is also a major complication after cataract surgery and the prevalence is estimated between 1.2% to 11.0% in the absence of any further problems or risk factors (Erikitola, Siempis et al. 2021). The incidence of posterior capsule opacification, another frequently reported complication after cataract surgery, is observed at 11.8% annually, 20.7% at three years, and 28.4% at five years (Ivić 2021).

Future Projection and Alternative Paths in The Treatment of Cataracts

Artificial Intelligence (AI) research in ophthalmology has advanced quickly in the last several years, particularly in the domains of deep learning and machine learning (Wang, Keane et al. 2022). This might set off a revolution that completely upends the field of ophthalmology. AI systems have been applied in the treatment of retinal diseases and managing glaucoma (Wang, Keane et al. 2022). Various testing methods have been proposed for automated glaucoma detection using deep learning, such as optic nerve imaging, optical coherence tomography, and visual fields (Christopher, Bowd et al. 2020). AI using fundus images may potentially be beneficial for diagnosing and screening retinal conditions, such as diabetic retinopathy and age-related macular degeneration (AMD) (Dong, Yang et al. 2021).

The use of AI for cataracts is expanding, and research has shown that deep learning is more effective than automatic cataract grading techniques when it comes to grading nuclear cataracts from cross-sectional slit lamp pictures using the Wisconsin grading system when compared to professional graders (Chen, Xu et al. 2021). It is still unclear, though, if artificial intelligence (AI) can be used for surgical purposes, as research on the technology has only helped with diagnosis. Thus, AI might soon find its way into routine surgical treatment and develop a novel tool benefiting both patients and physicians. It will also help in avoiding severe complications related to surgical procedures.

The financial burden of complicated cataract cases has increased, and the development of postoperative problems has led to serious thought being given to screening medications for the treatment of cataracts (McGhee, Zhang et al. 2020). Oxidative stress is the most common cause of cataracts (Nsonwu, Ozims et al.). It has been demonstrated that reactive oxygen compounds and antioxidants including GSH tripeptide (γ- L-glutamyl-L-cysteinyl-glycine), Vitamins E/C, zeaxanthin, lutein, carotenoids, and L-cystine, protect lens lipid peroxidation and prevent cataract formation (Heruye, Maffofou Nkenyi et al. 2020). Commercially available antioxidant drops, such as Quinax (USA) and Vita-iodurol (France), have also been used to treat cataracts (Chen, Xu et al. 2021). Quinone also has a crucial role in the pathophysiology of cataracts (Varma, Devamanoharan et al. 2021). Low amounts of quinones have the potential to interact negatively with lentic proteins (Varma, Devamanoharan et al. 2021). Pirenoxine was first made available for purchase as an eye drop in 1958 to delay the onset of cataracts (Hu, Liao et al. 2011). Pirenoxine reduces the progression of cataracts by blocking the sulfhydryl interaction with lentic proteins (Hu, Liao et al. 2011). Yet, the creation of cataracts is still a challenge, despite advancements in ophthalmic medicine.

There have been two innovative investigations that carried out recently. In one, Makley et al. discovered that by increasing the activity of the α-crystallin chaperone, the molecular 5-cholesten-3β,25-diol, disulfate (25HCDS), may correct cataracts associated with α-crystallin mutations (Makley, McMenimen et al. 2015). Another inspired effort showed that lanosterol is a universal compound for reversing the formation of cataracts, in contrast to therapy that is effective just for α-crystallin mutation-related cataracts

(Zhao, Chen et al. 2015). Furthermore, as shown in animal studies, lanosterol may both prevent and reverse lentic protein aggregation (Xu, Fu et al. 2020). These ground-breaking researches have been hailed as "A new dawn for cataracts" in science and offer a revolutionary approach to cataract management.

Studies on drugs like lanosterol have been carried out more recently. Using molecular dynamics simulations, Kang et al. demonstrated that lanosterol can interfere with γD-crystallin aggregation by attaching itself to the hydrophobic domain (Kang, Yang et al. 2018). The experimental study showed that lanosterol may be able to stop the aggregation brought on by βB1/2 crystallin aggregation (Kang, Yang et al. 2018). While some have countered that lanosterol cannot stop protein aggregation, research has demonstrated that lanosterol can stop and even reverse universal aggregation, most likely by stimulating the ubiquitin and proteasome systems (Upadhyay, Amanullah et al. 2018). Yet, the effectiveness of lanosterol is highly correlated with the severity of cataracts (Zhao, Chen et al. 2015). Consequently, there is a need to keep researching efficient synthetic compounds. Research and assessment of the lanosterol derivatives in lentoid bodies (LBs) and animal models are underway. It was discovered that when LBs with cataracts were given a specific form of lanosterol derivative, they turned translucent (Zhang, Qin et al. 2022). This study demonstrated the potential of pharmaceutics and supports the anti-aggregation action of lanosterol derivatives in human cataracts.

Conclusion

Research on drugs for cataract prevention and treatment has advanced, however, ophthalmologists still look forward to a pharmacological approach to the treatment of cataracts. Medicine and drug research is currently ongoing, albeit there haven't been any controlled clinical trials up to this point. As such, surgery continues to be the only effective way to treat cataracts. Even with the abundance of pertinent and significant prior findings, there is still much to learn about cataract reversal. The potential for cataract treatment is provided by these anti-aggregation agents. We anticipate that the future of cataract medications will have new advances.

Declarations

Ethics Approval and Consent to Participate

Ethics approval is not applicable as the paper does not report any findings from primary or secondary data.

Consent for Publication

Not applicable as no patient information or data is involved.

Author Contributions

TA is a consultant ophthalmologist and is a student of Master of Surgery in Ophthalmology. This paper is written and reviewed by him.

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Competing Interests

The authors declare that there is no conflict of interest.

Availability of Data and Materials

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