Future scenario in cataract surgery

According to the World Health Organization, cataract is the main cause of preventable blindness.[1] The global prevalence rate of visual impairment due to cataract rose from 791.4 per 100,000 population to 1253.9 per 100,000 population in 2019 and disability adjusted life years (DALYs) rose from 65.3 per 100,000 population in 1990 to 86.3 per 100,000 population in 2019.[2]

Out of the 22 million blind people worldwide, about 12 million are found in India. The annual incidence of cataract in India is about 3.8 million and the backlog is about 6 million people annually. In India, cataract has been reported to account for 50%–80% of the bilaterally blind (where vision is <20/200 in the better eye) in the country.[3] Cataract surgery and the dispensing of spectacles are among the most cost-effective healthcare interventions currently available.[4,5]

Cataract was recorded in the Egyptian tombs dating back to 1860 BC in Saqqara, but the first recorded details of how cataract surgery was performed are traceable to Sushrut Samhita, Uttar Tantra in about 800 BC. It is an amazingly detailed record indicating knowledge of the anatomy of the eye and even detailing the postoperative care. The Indian surgeon described a curved needle used for a procedure where the lens was pushed out of the line of vision using this curved instrument after which the eye was bandaged with butter. Another description of a type of sutureless extracapsular cataract extraction (ECCE) is described. In this technique, a sharp needle was used to puncture the eye through the aqueous humor until it reached the anterior capsule of the lens where an incision was made. The patient was then instructed to perform a valsalva procedure with closed nostrils until the lens material came out through the incision. Postoperatively, certain herbs, roots, and leaves were applied in a bandage and the patient was instructed to lie flat and avoid strenuous activities including coughing and sneezing.[6,7]

Though couching was a rough method with a sharp needle through limbus pushing the lens into the vitreous with various side effects—for example, lying prone, infection due to lack of aseptic conditions, secondary glaucoma, hyphema and endophthalmitis—it remained in use due to lack of alternatives till 1747 when the French Surgeon Jaques Daviel, the father of Modern Cataract Surgery, performed ECCE. He would make a 10-mm corneal incision with a corneal knife and then use a blunt needle to puncture the lens capsule to extract the lens using a spatula and curette the remaining material out. Postoperative dressing with cotton soaked in wine and rest in a darkened room for few days completed the recovery. Complications like posterior capsule opacification, retained lens material, and infection were a common occurrence.[8] In 1753, Dr. Samuel Sharp removed lens bag complex, thereby giving rise to aphakic condition. Vision was restored with high hypermetropic glasses. Complications such as vitreous prolapse, delayed retinal detachment, and a large incision leading to longer healing period with a higher infection rate were common.[9]

The next great improvement came when the intraocular lens (IOL) was developed. Before this, the majority of patients required +10 diopter sphere (Dsph) with cylinder number for distance and addition of +3 Dsph for near vision. The objects looked 25% enlarged. If one eye cataract operated and other eye is normal, with aphakic optical correction then pateint will complaint of double vision.

Sir Harold Ridley famously quipped, "Extraction alone is but half the cure for cataract." In 1949, Ridley performed the first IOL implantation in St. Thomas Hospital, London, using a poly-methyl-methacrylate lens. But he faced disdain from his peers due to frequent occurrence of glaucoma, inflammation, frequent dislocation of the IOL, and the inability to individualize the refractive strength of the IOL.[10] In 1978, Kai-Yi-Zhou implanted the first foldable IOL made of silicon through a small-incision of 3 mm leading to faster healing, less infection, and faster rehabilitation of his patients.[11]

Modern Cataract Surgery

Broadly the advancement has happened on four fronts:

1. Machine phacoemulsification: Dr. Charles Kelman introduced phacoemulsification in 1967, reducing the size of the corneal incision from 10 mm to 3 mm. A three-dimensional (3D) visualizing system was developed. In 2010, femtosecond laser–assisted cataract surgery (FLACS) was introduced. We also add the recent introduction of the omniglow system to this list as it is an innovative solution to the visualization problem.
2. Skill advancements: Dr. Amulya Sahu's 2-mm manual small-incision cataract surgery (MSICS), Dr Jagannath Boramani's wound modulation and astigmatic-free MSICS, Dr. M. S. Ravindra's tunnel floor entry phaco section, Dr. Rajeev Raut's smart incision MSICS, and Dr. Anil Shah's snare-assisted MSICS are areas of interest in the field of MSICS at the present moment in time.
3. Advancement on lens front: In 1992, the first toric IOL was developed to tackle astigmatism.[12] Multifocal IOLs (1990s), accommodating IOLs (2000s), and extended depth of focus IOLs (2010s) were developed to get spectacle independence. Lens materials and designs have also undergone improvements to reduce opacification rates and improve vision. Lens power calculation methods are continuously improving and outcomes are more precise postoperative refractive outcomes.
4. Anesthesia: Retrobulbar anesthesia has largely been replaced by peribulbar and topical anesthesia ever since Fichman operated with topical anesthesia in 1993.[13]

Where do we go from here?

Cataract surgery has been performed since the beginning of recorded history. The last four centuries have seen drastic changes in the surgical techniques with the evolution having been accelerated in the last half of the century. Machines and technology are undoubtedly improving and the journey will continue in the foreseeable future. However, the impact on outcomes with many of the iterations has been limited. In fact, the machine-less and the machine-driven small-incision cataract surgery have little to separate them if clinical outcomes are considered as endpoints.[14,15] So the parallel advancements in MSICS like 2-mm incision, smart incision, nucleus management, and astigmatism management techniques are the starting points for research and development in cataract

surgery. India had given the gift of cataract surgery to the world in ancient times. Is this going to be the beginning of another chapter in the artistry from the "Magicians of the East"? Only time will tell.

Amulya Sahu

Founder Chairman, Kamal Netralaya, Mumbai,
Founder Chairman, ISMSICS,
Maharashtra, India.
E-mail: dramulyasahu13@yahoo.com

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About the author

Dr. Amulya Sahu

Dr. Amulya Sahu is the Managing Director and Medical Director of Kamal Netralaya, Mumbai. Mumbai. Following his MBBS from SCB Medical College, Cuttack, and MS (Ophthalmology) from Grant Medical College, Mumbai, excelling in cataract surgery and fine-tuning manual small-incision cataract surgery to the state-of-the art, he has been passionately advocating and teaching his technique of 2-mm MSICS to ophthalmologists across India and the World. He has been the Secretary and President of the Bombay Ophthalmological Association and is the founding President of the International Society of Manual Small-Incision Cataract Surgeons and has been responsible for its tremendous growth. Dr Sahu has lectured across the world, has written several significant scientific articles and has been richly awarded. But the best complement to Dr Sahu is that he is the idol of the common ophthalmologist – from whom they have learnt the art of MSICS, which has revolutionised their individual practices.