



Cataract Surgery in Asian Countries – An Overview

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Authors' contributions

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ABSTRACT

Cataract, the leading cause of blindness in the world, is treated with surgery, and is the most common eye surgery performed. A PubMed search was done to review the spectrum of practice of cataract surgeries in Asian countries. Coverage for surgeries varied in different countries which depends mainly on the surgical facilities available in the region or country. Outreach programs, free surgeries and reimbursement of transport influence this. The cost of cataract surgery depends on type of cataract operation, government/private hospital, and facilities provided in the hospital, day care/in patient surgery, and economic status of people in the region/country.

Phaco surgery was more expensive than extracapsular cataract extraction (ECCE) and manual small incision cataract surgery (SICS). Intracapsular cataract extraction (ICCE) was cheaper than ECCE in India. Local anaesthesia (retrobulbar, peribulbar, subtenon and topical) is used compared to general anaesthesia. Pain was more in topical compared to regional anaesthesia though no pain was reported for phacoemulsification under topical.

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Several manouveres have been utilised in difficult cases to optimise the outcomes. These include invention and modification of instruments, phacodynamic settings and surgical techniques. Specific regimes for pupillary dilatation have been recommended. In Diabetics, trenching was difficult. Elimination of cotton balls reduced fibres in the anterior chamber. Innovations in intraocular lenses (IOL) are glued IOL, Artisan iris fixated IOL, intrascleral fixation of IOL with Y sutures. Visual outcomes varied based on techniques of surgeries and types of IOLs used. The advancement of techniques and instrumentation has benefited patients with cataracts by improving outcomes.

Keywords: Cataract surgey; intracapsular cataract extraction; extracapsular cataract extraction; phacoemulsification; manual small incision cataract surgery; posterior capsule rupture; vitreous loss; visual outcome.

1. INTRODUCTION

Cataract is a major public health issue regarding blindness in the society, and it is the leading cause of curable blindness in the world affecting nearly 18 million people [1]. Cataract can occur from infancy to old age. In unoperated congenital cataract patients the blind years will be much more than in senile cataract patients, affecting the productivity of the country and there will be lot of social responsibility on the family to look after them. Cataract surgery is the most common eye surgery performed all over the world.

A review on cataract surgery practice in Asian countries was done through Pub Med, Google and Science Direct search using key words such as prevalence of cataract, cataract surgical coverage, cost analysis of cataract surgery, anaesthesia, various types of cataract surgeries, intraoperative techniques, innovations, intraoperative manoeuvres, intraoperative complications, various types of intraocular lenses used, postoperative complications, visual outcome of surgical techniques and recent advances in cataract surgery. The study was conducted from 1st June 2015 to 30th November 2015.

2. HISTORY OF CATARACT SURGERY

Cataract surgery is one of the oldest surgical procedures known and was first documented in the fifth century [2]. It has evolved from couching (using a sharp instrument to push the cloudy lens to the bottom of the eye.) to modern day phaco. Maharshi Sushruta, an ancient Indian surgeon, first described the procedure in "Sushruta Samhita, Uttar Tantra", an Indian medical treatise (800 B.C.) Since then the procedure was widespread throughout the world. Evidence shows that couching was widely practiced also in China, Europe, Africa. After the 19th century, with the development of modern cataract surgery

(Intra ocular extraction of lens (1748), couching fell out of fashion, though it is still used in parts of Asia and Africa [3].

In later years, intracapsular cataract extraction was practiced by making an incision half way around the circumference of upper part of cornea with a fine sharp cataract knife taking a small conjunctival flap at 12 o'clock position. The assistant lifts the cornea up by holding the conjunctival flap, and the fully opaque cataract was removed by the surgeon with intracapsular forceps as one piece without breaking it. At that time, sutures were not available and sandbags were kept on either side of the patient's neck to prevent free movement of the head, for few days of wound healing time. This procedure was also used in hard, totally opaque lenses (mature cataracts) so that it would not break during the operation. The main disadvantage was the patient has to wait till the cataract was totally opaque [4].

Later on, the development of the technique where the nucleus and cortex were removed one after the other leaving the capsule behind (extracapsular cataract extraction) made the people not to wait for a less opaque lens (immature cataract) to be removed. The intact capsule served as a barrier preventing lens material from falling into vitreous and the lens fragments were aspirated. The incision size was less because the lens was removed in stages and the introduction of fine sutures greatly enhanced the safety of the surgery and also the outcome.

The most significant change in the modern era of cataract surgery was introduction of phacoemulsification by Charles Kelman in 1967, where ultra sound energy is used to break the nucleus into fragments that can be aspirated. A combine hand piece (ultrasound energy, irrigation, aspiration) allowed removal of lens

through small (3 mm) two entry wounds (corneoscleral/corneal tunnel) which does not require suturing [4].

Originally, no intraocular lens (IOL) implants were used following cataract surgery and patients used thick hypermetropic (aphakic) glasses. These were associated with lot of optical aberrations. The technological advances in the manufacture industry made it possible to have different varieties of IOLs (monofocal rigid – polymethyl methacrylate and foldable – silicon, acrylic, multifocal – for distance as well as for near correction) for better visual outcome following phacoemulsification surgery [4].

3. PREVALENCE OF CATARACT IN ASIAN COUNTRIES

The prevalence of cataract depends upon the age of subjects, level of health care facility, region or country, urban or rural population studied. The prevalence of unoperated cataract in people aged ≥ 60 was 58% in north India and 53% in south India ($P=0.001$) [5]. Prevalence of cataract in adult Koreans over 40 years of age was 40.2% ($P<0.01$) [6]. In a National Eye Survey, cataract was the major cause of bilateral blindness accounting for 39.1% in Malaysia [7], while it accounted for 60% of blindness and severe visual impairment in Hanian province, China [8]. In Indonesia, the prevalence rate of any cataract for adults aged 21 to 29 was 1.1%, increasing to 82.8% for those aged older than 60 years. Increasing cataracts was seen with decreasing education ($P<0.001$) [9].

4. CATARACT SURGICAL COVERAGE (CSC)

Cataract Surgical Coverage compares the proportion who have received surgery (aphakic and pseudophakic) to the total, who still need or have had surgery (aphakic/pseudophakic + operable cataract) in a certain area. It indicates to what extent the services have covered the needs. It measures the effectiveness of the cataract intervention programme in providing surgical services and, as such, it is an output indicator and does not measure the quality of cataract intervention. In India, large number of ICCE operations have been performed in temporary operation theatres in one of the rooms of the building where screening and surgical eye camps were organized in rural areas by non-governmental organizations for many years. The patients were examined by a team of ophthalmic surgeons and after the selected patients were

operated under retrobulbar anaesthesia by them like in the hospital theatres. The patients were seen daily for five days by one of the doctors who stays in the camp area and then discharged for further follow up in the near by hospital. The practice of eye camps is still on-going, but the patients are transported to government hospitals with permanent operation theatres where ECCE with intraocular lens implantation is done.

In Myanmar CSC was 13.47% for vision worse than 3/60 and 9.39% for vision worse than 6/60 [10], while the cataract surgical coverage for those above 40 years was 50.0% and 12.9%, for bilateral best corrected vision of worse than 3/60 and 6/60 respectively in Yunan province, China [11]. In Nepal the proportion of blind eyes operated was higher in rural (50.7%) compared to urban (38.9%) areas [12]. Outreach patient screening and international nongovernmental development organization investment increased surgical rates and were tools to achieve China's Blindness Prevention Plan [13]. Provision of free cataract surgeries and reimbursement of transport increased the number of cataract operations in a rural community in China [14]. Cataract surgical coverage varies among countries and cover less than 50%. The needs may be higher.

5. COST ANALYSIS OF CATARACT SURGERY

In general, the cost of cataract surgery depends on type of cataract operation, government/private hospital, and facilities available in the hospital, day care/in patient surgery, and economic status of people in the region/country. Singh et al. [15] assessed the cost-effectiveness of public-funded options for delivering cataract surgery in Mysore, Karnataka state, India and found out that camps were a low-cost option, but the poor outcomes reduced their cost-effectiveness to US\$97 per patient. The state medical college hospital was least cost-effective, at US\$176 per patient, and the non-governmental hospital was the most cost-effective at US\$54 per patient. In Malaysia conventional extracapsular cataract extraction surgery with intraocular lens implant costs RM3442 (USD906) and phacoemulsification with intraocular lens implant costs RM4288 (USD 1128) [16].

Bharatpur eye Hospital in Nepal reduced the number of diagnostic screening and treatment camps by one half (151 to 75) in an attempt to increase both the efficiency of its outreach

program and the number of people that go directly to the hospital for service. The cost per cataract surgery decreased from US\$ 3.80 to \$3.20 [17]. The mean total cost per cataract intervention of four different providers varied considerably, ranging from US\$ 1,293 in Union Hospital to US\$ 536 in Jingshan County Hospital in China [18]. The average total cost was 10,043.81 bath/case (US\$ 310) for manual small incision cataract surgery and 11,590.72 bath/case (US\$ 357) for phacoemulsification surgery in Thailand [19]. In Arvind Eye Hospital India, the cost for cataract surgery ranged from \$41 to \$125 per case [20]. Laskar [21] reported that the cost for providing the service to the patient for ICCE operation was estimated to be INR519 (US\$ 9) and for ECCE+IOL implantation it was INR769 (US\$13) during the evaluation of cost effectiveness of national program for control of blindness in Jorhat district in Assam state, India. Further studies need to be done to look at cost of surgery based on percapita income to know if surgery is affordable.

6. ANAESTHESIA FOR CATARACT SURGERY

In Asian countries, cataract surgery is performed under local anaesthesia in majority of patients. General anaesthesia is indicated in children and in special patients like Parkinsonism, epilepsy, deaf mute, mentally retarded, psychiatry patients under active treatment, retrobulbar haemorrhage in previous attempt of surgery and patient's request inspite of explaining risks of general anaesthesia. Local anaesthesia has evolved from retrobulbar to peribulbar, subtenon, and topical supplemented with intracameral anaesthesia.

In a meta-analysis of topical anaesthesia versus regional anaesthesia for cataract surgery, Zhao et al. [22] reported that pain was higher in the topical group when compared to regional anaesthesia, while Sarkar et al. [23] reported that no pain was experienced under topical anaesthesia in phacoemulsification surgery. However, Parker et al. [24] found no difference in pain between subtenon and peribulbar anaesthesia in patients undergoing manual small incision cataract surgery.

After conducting a study to compare the intraoperative pain scores during clear corneal phacoemulsification under no anesthesia, topical anesthesia, and topical plus intracameral anesthesia, Pandey et al reported that a highly

experienced and skilled surgeon can perform no anaesthesia clear corneal phacoemulsification surgery without causing an unacceptable level of pain. However, this technique is not suitable for every cataract surgeon [25]. After the analysis of different types of anaesthesia used and the associated complications with each type in 12992 cataract operations data obtained from national eye Database of Malaysia, Thevi and Godinho reported that topical anaesthesia has shown a steady increase in usage and is the ideal anaesthesia, which has been associated with fewer complications [26].

7. INTRAOPERATIVE MANOUVERS DURING CATARACT SURGERY

In general, every cataract surgeon aims to complete phacoemulsification successfully without complications. Sometimes, the intraoperative scenario such as pupillary miosis, posterior capsule rupture, prolonged phaco time, posterior extension of the capsulorhexis, corneal thermal burn, subluxation of the lens, and malfunctioning of the ultrasonic handpiece which makes the surgeon to convert phaco surgery to ECCE has been reported [27].

Lowering of saline flow rate after the first suction of iris by phacotip to avoid further iris damage such as iridodialysis was suggested by Oshika et al. [28]. When the posterior capsule tear occurs during phacoemulsification, low flow rate, high vacuum, and low ultrasound were advocated by Vajapayee et al. [29]. Peripheral radial chop technique was useful for hard cataracts in China [30]. Phaco windmill: nondividing, nonchopping phacoemulsification technique for nucleus removal in which less phaco energy is used to avoid zonular stress has been described by Keum et al. [31]. Park et al. [32] reported less ultrasound time, lower mean cumulative dissipated energy, and less use of balanced salt solution with the phaco-chop technique than with the divide-and-conquer and stop-and-chop techniques in micro incision coaxial cataract surgery in patients with grade 4 cataract density group.

In eyes with subluxated cataracts and phacodonesis during phacoemulsification, modified capsule expander implantation to reposition and fixate the capsular bag was described by Asano et al. [33]. For subluxated cataracts and IOLs, a device made of IOL haptic material (polyvinylidene fluoride) that allows sutureless fibrin glue-assisted transscleral

fixation of the capsular bag was invented by Jacob et al. [34]. Nishimura et al. [35] invented a flexible (10 mm in length, fashioned from 5-0 nylon) capsular stabilization device used for suspending a lens with weak zonular support. Flexible iris retractors to stretch and fixate the capsulorhexis over the zonular dehiscence sector were used by Tsai et al. [36] during phacoemulsification, to stabilize the capsular bag and facilitates cataract extraction without complications.

Removal of mature cataracts by a subconjunctival limbus oblique incision was described by Yang et al. [37]. Advanced (mature and brunescant) cataract patients were operated with a new surgical technique of manual small incision cataract surgery (MSICS) in Thailand [38]. In white mature cataracts in India, a small capsulorhexis was done initially; endophacoemulsification was performed using the stop, chop, chop, and stuff technique; capsulorhexis was enlarged before intraocular lens implantation [39]. Kim and Jang [40] described drill and chop technique for hard cataracts in Korea in which an effective and safer technique of vertical chopping with a short blunt chopper was done after drilling a hole into the endonucleus.

Joe and Kim [41] advocated a technique for in situ lens nucleus emulsification using low phaco power and high vacuum, a continuous curvilinear capsulorhexis, and hydrodelineation. Emulsification is done with the phaco tip slanted down 30 or 45 degrees. Cutting and aspiration do not cause an undesirable energy loss. This technique can be combined with the nuclear chopping or divide and conquer methods because of its ability to drill and hold the nucleus. Posterior capsular rupture is prevented because the separated epinucleus acts as a barrier between the nucleus and the cortex. The low power used minimizes the energy transfer to the corneal endothelium. This technique is particularly useful in eyes with brunescant cataract.

A small-gauge, single-port, sutureless transconjunctival limited pars plana vitrectomy facilitates phacoemulsification in phacomorphic glaucoma cases [42]. In eyes with phacomorphic glaucoma, intumescent cataracts are decompressed by filling the anterior chamber with viscoelastic; a 30-gauge needle is then used to aspirate liquid cortex, which facilitates a controlled capsulorhexis [43].

Mydriatic cocktail regimen consisting of 1:1:1:1 ratio of 2.5% phenylephrine, 0.5% moxifloxacin, 1% cyclopentolate, and 0.03% flurbiprofen eye drops soaked in sponge and placed in the lower fornix achieved better dilatation compared to conventional topical instillation of same drops [44].

Modified Malyugin ring for iris expansion in nondilating small-pupil cataract surgery with preexisting posterior capsule defect or intraoperative posterior capsule tear was used by Agarwal et al. [45]. In eyes with small pupils of 4.0 mm or less size, the modified technique of phacoemulsification included creation of deep central space, use of a low aspiration flow rate with appropriate vacuum, and step-by-step chop in situ and lateral separation of the nucleus [46].

Topical nonsteroidal anti-inflammatory agents, Diclofenac and Pranoprofen [47] and one bolus of an extremely dilute concentration of epinephrine (i.e., 1:400,000) injection [48], injection of ophthalmic viscosurgical device into the anterior chamber [49] were alternative measures tried for maintaining mydriasis during phacoemulsification.

Although trypan blue, ICG, gentian violet, fluorescein, and autologous blood were safely used to stain the anterior capsule for phacoemulsification in eyes with white cataract, trypan blue, ICG, and gentian violet were more effective in staining the capsule [50]. Trypan blue was found to be slightly superior to indocyanine green for staining of the anterior capsule in white cataracts [51]. Mechanical cortical-cleaving dissection technique, in which hydrodissection step is not performed, was found to prevent complications of hydrodissection such as posterior capsule rupture [52]. Bimanual microincision cataract surgery using an 18-gauge needle as the irrigating chopper combined with silicone oil removal was a safe alternative to phacoemulsification in a vitrectomized eye [53]. Microphakonit, the smallest incision for phacoemulsification performed with a 0.7 mm phaco tip and 0.7 mm irrigating chopper was reported by Agarwal et al. [54]. Horizontal or oblique intracameral illumination minimized the amount of corneal scatter and reflection of the illuminating light and provided high-quality intraoperative lens images in most surgical steps. In addition, excellent visibility of the lens capsules facilitated the removal of almost all lens epithelial cells from the capsular bag, in eyes undergoing advanced cataract surgery combined

with 23-gauge vitrectomy [55]. Surgeon controlled endoillumination guided irrigation and aspiration technique was found to facilitate posterior capsule polishing with no intraoperative complications in eyes with a poor red fundus reflex [56].

Limbal relaxing incisions during phaco were reported to be effective in reducing postoperative astigmatism with good predictability of intended angle [57]. Viscoexpression technique of nucleus delivery in MSICS has been described by Gokhale [58] where continuous injection maintains the chamber under pressure and forces outward nuclear movement. A manual nuclear fragmentation technique, forceps-guided nuclear cleavage technique was invented in China for cataract extraction [59].

Use of Cionni modified capsule tension ring (CTR) during phacosurgery in subluxated cataracts ensured a stable IOL with few intraoperative complications [60]. Capsule tension ring implants were found to be useful in difficult and complicated cases (hypermature cataract with lens induced glaucoma, pseudoexfoliation syndrome, post blunt injury traumatic cataract, cataract with iridochoroidal coloboma, marfan syndrome). In such cases, good post-operative results have been reported with the use of aCTR type 12 (12-10 and Cionni Ring 12 by Rai et al. [61]. Slow IOL insertion affected clear corneal wound structure more than fast IOL insertion when using an injector in Japan [62]. After completing a comparative study of new motorized injector vs manual injector for implantation of foldable intraocular lenses on wound integrity, Khokar et al. [63] found that the motorized insertion system was gentle and safe for the IOLs with lesser incidence of IOL nicks and it caused significantly less incision enlargement and better posterior wound integrity.

8. INTRAOPERATIVE COMPLICATIONS

Manual small incision cataract surgery is being done in large numbers in the developing countries, especially in patients who come from low socioeconomic status and from rural areas. Its cost for the patient is much less than phacoemulsification with less severe complications. In high volume cataract surgery of 1087 eyes that underwent manual small incision cataract surgery (MSICS) in Nepal, intraoperative complications were very few (5.8%) which included posterior capsular rupture seen in 42

(3.9%), sclera corneal tunnel suturing in 12 eyes (1.1%), iridodialysis 5 eyes (0.5%) and Descemet stripping in 4 eyes (0.4%) [64]. Superior button-hole formation in 5%; posterior capsular rent in 5% and premature entry with iris prolapse in 3% cases were the complications that occurred in 300 cases of manual sutureless cataract extraction in Pakistan [65].

In Singapore, no statistical difference was found between the posterior capsule rupture (PCR) rates among different races [66]; they were lower in faculty staff compared to residents ($p < 0.01$) [67]. A similar finding was reported from China also [68]. The incidence of posterior capsule tear and vitreous loss was significantly lower in surgeries performed by left-handed residents than in those performed by right-handed residents in Korea [69]. The rate of PCR during phaco surgery was higher in previously vitrectomized eyes than in eyes with combined vitrectomy and phaco [70].

One of the most reliable signs of hydro rupture of the posterior lens capsule is the "pupil snap sign." In this sign, hydrodissection is initially accompanied by elevation of the nucleus, dilating the pupil slightly, followed by vigorous, abrupt pupillary constriction (the pupil snap), which is the moment fluid bursts through the posterior capsule [71]. Posterior capsular breaks in traumatic cataracts might be preexisting but can be detected only during surgery (centrally located, thick fibrosed margins which remained the same size during irrigation- aspiration) [72].

Premature entry of the tunnel into the anterior chamber (1.9%), incomplete capsulorhexis (28.3%), posterior capsular tear (1.9%), conversion to a manual nonphacoemulsification technique (1.9%), intraoperative miosis (3.3%), and iris chafing (0.9%) have been reported as intraoperative complications of phacosurgery in 212 consecutive patients with white cataract: 192 mature, 11 intumescent, and 9 hypermature [73].

Other complications reported in phacosurgery are radial and posterior capsule tear, dislocation of nucleus [74], dislocation of the lens nucleus into the vitreous cavity immediately after continuous tear capsulorhexis and hydrodissection of the nucleus [75], sucking of iris into the phacoemulsification tip resulting in severe iridodialysis [76] and intraoperative floppy iris syndrome due to oral imipramine therapy [77].

Intraoperative striae in many patients who had Acrysoft IOL implantation were associated with relatively older age, greater lens thickness, and shorter axial length without any residual effect on vision [78].

In a study of surgical peculiarities in Diabetics during cataract surgery, it was found that in 24.13% of the cases, the nucleus could not be divided after initial trenching as they were leathery [79]. Cotton fibres were found intraoperatively in anterior chamber in 6.4% of cases in Japan. Eliminating cotton balls reduced the frequency of fibers by 1.5% [80].

The Capsular Block Syndrome as intraoperative (CBS seen at the time of lens luxation following hydrodissection), early postoperative (original CBS), and late postoperative (CBS with liquefied aftercataract or lacteocumenasia) [81]. Intraoperative capsular block syndrome masquerading as expulsive haemorrhage [82] and the same mimicking as threatened expulsive haemorrhage [83] were described in Singapore. Intracameral injection of triamcinolone acetonide was useful in complete removal of vitreous in posterior capsule rupture with vitreous loss [84].

A new technique of sutureless fibrin-glue-assisted PCIOL implantation was first described in India in 2009 in a case of retinitis pigmentosa with severe capsular contracture causing in-the-bag IOL subluxation [85]. Glued IOLs were safely implanted in eyes with microcornea using modifications such as custom haptic trimming and 6.0 mm optic foldable IOLs [86].

A study in China for secondary anterior iris fixation of the Artisan iris-fixated intraocular lens (IOL) to correct aphakia in eyes without sufficient capsule support found it effective, predicatable and safe with no serious complications [87]. In non progressive zonular dialysis, the haptics of IOL are positioned in the sulcus while the optic is pushed behind the posterior capsular opening therefore "buttonholding" the IOL [88]. Intrasceral fixation of a posterior chamber IOL without sutures using Y fixation technique has been done in Japan [89]. Kumar et al reported intraocular lens decentration was due to haptic-related problem in their study of glued foldable intraocular lens implantation in eyes with inadequate capsules [90].

9. VISUAL OUTCOME OF CATARACT SURGERY

Visual outcome for phaco was better than ECCE ($p=0.001$) in Malaysia [91]. In Nepal, both phaco

and SICS achieved good visual outcomes with low complication rates [92]. Best corrected visual acuity was not significantly different ($p=0.30$) but the speed of surgery was significantly faster in SICS ($p<0.0001$) and therefore SICS is more appropriate in a developing world setting.

In a country like India where the cataract surgical load is very high, it was found that SICS was technically easy to perform compared to phacoemulsification with equally good visual outcome to combat cataract blindness as it had lowered patient's cost compared to phaco and ECCE [93]. High volume charitable cataract surgery in Pakistan found that implantation of IOL had good outcome (93%) compared to no IOL (53%) following cataract surgery [94]. In China, poor visual outcome following cataract surgery was found to be due to treatable conditions such as uncorrected aphakia, refractive errors and PCO [95].

In a Cochrane review of trials in Nepal and India, SICS had better output compared to ECCE [96]. Meta-analysis in China found that bimanual microincision cataract surgery (B-MICS) had similar outcomes of visual acuity and complications compared with standard coaxial small-incision cataract surgery (C-SICS) [97].

Prolonged high IOP during phaco was found to have more anterior chamber inflammation and oedematous corneas in India ($p<0.001$) [98]. Poor outcome in phacomorphic glaucoma in Nepal were due to optic atrophy (34%), uveitis (26.6%) and corneal oedema (25.5%) [99]. In high volume cataract surgery of 1087 eyes that underwent manual small incision cataract surgery (MSICS) in Nepal, 62.1% of all patients attained uncorrected visual acuity 6/18 or better [64].

A meta analysis in China found that Refractive IOLs can provide better distance vision, whereas diffractive IOLs provide better near vision, reading ability, and equivalent intermediate vision, reduce unwanted photic phenomena, and allow greater spectacle independence [100]. In a comparison of multifocal, monofocal and accommodative IOL in China, all 3 types of IOLs allowed greater distance visual acuity; however, multifocal IOLs produced better DCIVA (distance corrected and intermediate visual acuity) and DCNVA (distance corrected and near visual acuity) and more pseudoaccommodation and spectacle independence [101].

Sectorial refractive multifocal intraocular lens implantation is effective for treating cataract eyes complicated with ocular pathologies such as keratoconus, branch vein occlusion and glaucoma as found in Japan [102]. Phacoemulsification with toric lens implantation in anterior lenticonus with spontaneously ruptured anterior capsule had good visual outcome [103]. In a metaanalysis in China, the hydrophobic acrylic IOLs showed superior reduction in rates of PCO and laser capsulotomy in 2-year follow-up when compared with hydrophilic acrylic IOLs [104]. Foldable glued-IOL procedure showed satisfactory visual outcomes without serious complications. The postoperative CDVA was 20/40 or better and 20/60 or better in 38.9% and 48.5% of eyes, respectively [90].

10. RECENT ADVANCES IN CATARACT SURGERY

Femto-laser assisted cataract surgery is now practiced in China [105] and Singapore [106]. In this technique laser is used to improve precision in the steps of cataract surgery to reduce complications and improve outcomes but it is a costly procedure. China has developed a new, regenerative medicine approach to remove congenital cataracts in infants, permitting remaining stem cells to regrow functional lenses [107]. The scientists reported fewer complications and faster healing among the 12 infants who underwent the new procedure and, after three months, a clear, regenerated biconvex lens in all of the patients' eyes.

11. SUMMARY

Cataract surgery is the most common eye operation performed in any country in the world. The invention of small incision cataract surgery (SICS) without using phaco machine (manual phaco) has helped thousands of cataract patients in the Asian countries as it is a safe technique with few complications, equally good visual outcome and less cost to the patient. There is no need of costly equipment, and learning/convert time for the surgeon is much less. The development of modern phaco machines, new types of intraocular lenses have benefited patients in the developed world to improve the visual outcome with much less complications. Most Asian countries are still developing and this is a challenge as far as infrastructure and expertise are concerned. The output varies based on the status of development. If circumstances do not permit due

to skills and equipment, then SICS is a good option for cataract surgery with good outcomes. More needs to be done to overcome blindness due to cataracts in Asian countries.

CONSENT

It is not applicable.

ETHICAL APPROVAL

Granted by Medical Research Ethics Committee (MREC). NMRR15-1120-26655.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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