



Evolution of and developments in simultaneous bilateral cataract surgery. Update 2020

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Abstract: The debate on role of ‘simultaneous bilateral cataract surgery’ (SBCS) continues. The world population has exponentially increased during last fifty years and average human lifespan has increased by a decade during the last century. This translates to ever increasing geriatric population with its inherent problem of preventable blindness because of cataract formation in the elderly. We are adding to the backlog of cataract surgeries not only in the ‘developing world’ but also in the ‘developed world.’ Times demand that we reconsider our old fashioned approach of staggering bilateral cataract surgeries. Serious, but a potential, risk of simultaneous bilateral infection/endophthalmitis has been the biggest deterrent in acceptance of SBCS as a routine procedure. The opponents of SBCS strongly believe in this argument that has not been documented when strictly followed the recommendations regarding separate procedures of each eye. The advantages of reducing the ever-increasing backlog of preventable/treatable blindness, faster visual recovery, economic benefits to patients as well as health care providers, lesser risk of amblyopia in pediatric population, and decreased risk of as serious a complication as death by exposure to general anesthesia in pediatric and adult population, etc. outweigh the disadvantages of SBCS when compared with ‘delayed bilateral cataract surgery’ (DBCS). SBCS is favored over DBCS in pediatric population and in uncooperative, mentally retarded and physically disabled adults needing general anesthesia to reduce the risks and complications of general anesthesia. Considering such factors and review of available literature strongly support that SBCS has a definite role where indicated, under certain circumstances, and in certain select group of patients in both developing as well as developed countries.

Keywords: Simultaneous bilateral cataract surgery (SBCS); delayed bilateral cataract surgery (DBCS); bilateral cataract extraction surgery; sequential bilateral cataract surgery; immediately sequential bilateral cataract surgery; and same day cataract surgery

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Introduction

Cataract surgery has been performed ever since the probable introduction of the procedure by Susruta (Sushruta) in India around 600 BC, although documented source comes from the 9th century CE (1-3). But, most of the advances have been only 150–200 years old. The earliest ‘documented’ SBCS procedure was performed by Chan and

De la Paz (4) in 1952 and was described as conducted “in one sitting”. There have been other early reports (5-9).

The indications for SBCS were desperate need to recover vision from poor vision graded between ‘light perception’ to 0.1 (20/200) vision, economic reasons to regain ‘functional’ vision (not the ‘best vision’) for productive and fruitful life, and/or under ‘Now or Never’ circumstances of inability to

seek or of inaccessible ophthalmic care. Mostly governed by the economic and logistical reasons, in the past this procedure had been frequently performed under such circumstances.

Simultaneous Bilateral Cataract (same day) removal has been resisted and argued against in the so called 'Developed World' (10-32) even though the argument is based on speculated reasoning (26-48).

Besides cataract other simultaneous intraocular surgery, such as, simultaneous bilateral trabeculectomy has been successfully performed under justified conditions (49). The US is the most resistant place for acceptance of SBCS (40,50) even though the numbers of ophthalmic surgeons endorsing the procedure around the world have been ever increasing (38).

The ophthalmic surgeons in the US have to stay within the guidelines put forward by the American Academy of Ophthalmology (AAO) which does not endorse SBCS yet (40,48,50). These guiding principles are based on hypothetical and potentially serious complications, such as endophthalmitis, Toxic Anterior Segment Syndrome (TASS), Corneal Endothelial Decompensation (also named as Pseudophakic Bullous Keratopathy), poorer refractive outcomes, and 'loss of vision' etc., that are associated with or are considered to be associated with simultaneous bilateral procedures (26,32,51-53).

Cataract surgeons in the United States face financial disincentives and expose themselves to medico-legal issues by performing SBCS on routine basis. They face financial penalties in the form of no reimbursement for the second eye operated on the same day (39,40,50,51). Despite these restrictions or limitations, more and more surgeons are joining the group that endorses same day bilateral cataract surgery (SBCS) (39). Similarly, such financial disincentives are imposed on surgeons performing SBCS in Israel and Japan (21,37,40,41), as well. They are not reimbursed for the second operated eye doing SBCS on the same day (34,40). In the United Kingdom, same day SBCS performing ophthalmologists are paid as low as 40% to 80% of the normal reimbursement for the second eye operated on the same day as the first eye (21,40). Australia and Canada are very close to the reimbursement pattern seen in the United Kingdom. Ophthalmologists in Australia are compensated at the rate of 50% for the second eye operated on the same day than the first eye (40). If these surgeons would stagger or follow the protocol of DBCS then they would be fully reimbursed and financially fully compensated for both eyes. Despite these disincentives, the number of SBCS performed in Canadian Province of

Ontario has increased almost two and a half times from 1.02% of total cataract surgeries in 2003–2004 to 2.36% in 2009–2010 (40). It is further reflected by 40% increase in total numbers of cataract procedures over the same period of time in Province of Ontario (40).

On the other hand some governments in Europe have determined SBCS to be as "safe and effective" as conventional DBCS (21,22,40). Spain is one of these governments that legally support and encourage SBCS, especially on the Canary Islands under its jurisdiction. And, no surprise, 80% of the cataract surgeries performed on Canary Islands are SBCS (22). Finland has led the way to fully endorse and support SBCS since 1996 (16,17). According to some reports, as much as 40–60% of total cataract surgeries performed in Finland are done as SBCS (30,31). A survey conducted by the ESCRS suggested that about 10% of its members have been performing SBCS since as early as 2009 (52,54). It is hypothesized that since then the number of surgeons performing SBCS has increased significantly in Europe and around the world (38). Similarly, there have been sporadic cases of SBCS performed in Poland in the 1980s–90s, but all were based on the health issues of the patient needing bilateral cataract surgery under general anesthesia. There a total of 48 operations were performed as SBCS from January to December 1985, and three cases were performed from March to June 1999; none of these cases developed postoperative endophthalmitis (10,55). Presently it is reimbursed by the National Health Service in Poland.

Definitions

Simultaneous: Concurrent, Immediate, Instantaneous, Synchronized, and Real-time are the Synonyms of word 'simultaneous'. In cataract surgery if we use the words 'simultaneous bilateral', by no means we interpret it as operating on both eyes exactly at the same time. It should be and is interpreted as 'same day bilateral surgery'. This terminology has been used from the early days of bilateral surgeries.

Delayed: Late, Deferred, and Overdue are the synonyms of word 'delayed.'

Sequential: Successive, Consecutive, Serial, Chronological, and Progressive are the Synonyms of word 'sequential.' In bilateral cataract surgery, the surgeries on two eyes are 'delayed,' 'staggered,' or 'sequential' by few days, weeks to months. We believe that this terminology 'delayed' better represents and interprets the real sense of staggered bilateral surgeries than the word 'sequential' and, therefore, be accepted

for ‘not same day bilateral surgery.’ It has been used for a long time and is still used in literature even today and regularly.

For this review of literature article, we have used terms ‘Simultaneous Bilateral Cataract Surgery (SBCS) for ‘same day’ surgery on both eyes of a patient, and ‘Delayed Bilateral Cataract Surgery (DBCS) for ‘not same day.’ This delayed bilateral surgery could be delayed/staggered/sequential by days to weeks to months.

We present the following article in accordance with the NARRATIVE REVIEW reporting checklist (available at <http://dx.doi.org/10.21037/atm-20-3490>).

Methodology for the review article

This is an article based on review of available literature, where the best efforts were made to include all the possible articles, studies, reports, commentaries, and abstracts etc. available on the subject in English language. Because of the language barrier, some original articles could not be reached but their abstracts translated into English were analyzed and included in this review. It is an attempt to put in perspective the evolution of cataract surgery to the stage where ophthalmic surgeons are performing or have started to perform SBCS. Best effort was made to include opinions of both sides of the on-going debate on the subject: SBCS versus DBCS.

The related literature available on PubMed, platform offered and sponsored by the US National Library of Medicine/National Institute of Health, Google search engine, Cochrane Database System Review and EPPI-Reviewer 4 gateway was the main source of this review. Efforts were made to include the most recent available literature along with the previously included material covered by previous reviews, journal articles, abstracts and reports. Total of 105 articles were found on the topic by using the following keywords: SBCS, DBCS, bilateral cataract extraction surgery, sequential bilateral cataract surgery, immediately sequential bilateral cataract surgery, and same day cataract surgery.

There was a lot of repetition in review articles and interviews, and some cross references were used where original article could not be found or could not be translated from the original language of publication.

Considerations and reasoning against SBCS and favoring DBCS

The opponents of SBCS make a case against performing

SBCS by suggesting the risks of ‘Bilateral Vision Loss’ as a result of potential bilateral complications (9,40). Some of the arguments to support their concerns are as follows.

Infections/bilateral endophthalmitis

The ophthalmic surgeons who are proponents of DBCS and raise concern against SBCS have serious but hypothetical reasons (as discussed later) to support their viewpoint. The most serious and valid reason against SBCS is the potential risk of ocular infection. Infectious endophthalmitis has been the most dreaded complication of intra-ocular surgery for the longest time (56-59).

The review of available literature dealing with this complication did not support the claimed potential risk of bilateral postoperative endophthalmitis (43). There were only four cases of simultaneous bilateral infectious endophthalmitis after cataract surgery reported (8,56,58,59). Closer look at these cases reveal that either there was poor patient selection and/or the sterility protocols were not followed meticulously. If the potential sources of infection are not ruled out pre-operatively by carefully looking at the ocular adnexa and naso-lacrimal passages, this dreaded complication would become a haunting reality even in DBCS cases. Addressing this issue, the International Society of Bilateral Cataract Surgeons (ISBCS) has put forward a strict protocol to be followed for SBCS (60). Agreeably, still there is a *potential risk* of simultaneous bilateral endophthalmitis. As we know infectious endophthalmitis could be of exogenous or endogenous origin (61). Careful exclusion of potential sources of infection are mandatory for both SBCS and DBCS.

At present, we have adopted to use intracameral antibiotics as a routine part of the cataract surgery procedure. Studies in the United States showed infection rates after cataract surgery and just using topical antibiotics were as low as 0.028% in unilateral procedures (40,52). Post-operative rate of endophthalmitis, only in one eye of SBCS cases (they used the term ISBCS; Immediately Sequential Bilateral Cataract Surgery), was only 0.017% (one out of 5,759 cases). This rate dramatically lowered to 0.007% (One out of 14,352 cases) when prophylactic intracameral antibiotic was used (52), again only in one eye of a patient operated simultaneously on both eyes on the same day (SBCS). It warrants to be stressed and repeated here that as we review the available literature, though there were sporadic cases of postoperative infection/ endophthalmitis yet important to note is that there was not

even one case of simultaneous bilateral endophthalmitis in total of 95,606 surgeries performed by SBCS (52).

If the surgeon is cautious, which he/she should be, and follows proper and strict guidelines and precautions while doing SBCS, probably the rates of postoperative endophthalmitis would be even lower than the published literature. We have successfully performed SBCS, without any complications of endophthalmitis, even in pediatric cases to prevent amblyopia, and using prophylactic oral and topical antibiotics (62).

Toxic anterior segment syndrome (TASS)

TASS is defined as an intra-ocular non-infectious sterile inflammation induced by exogenous factors/agents used during cataract surgery (28,31,40). Some of these agents and factors include the ingredients used in composition of Balanced Salt Solution (BSS), certain types of surgical gloves and the powder on those, lapses in cleaning and sterilization of surgical instruments and the detergents used in the process, and inappropriate concentrations of intracameral solutions, including prophylactic antibiotics, etc. (28,31,51). There have been epidemics of TASS in certain high volume surgery centers and the sources of problem were traced back to the manufacturing units of the culprit materials or equipment. These lapses in following the protocols and meticulous preparation of intracameral solutions and agents could be avoided and prevented by eliminating human or mechanical errors. This type of accidental complication because of 'system failure' can happen in either kind of procedure, SBCS or DBCS. This complication is not inherently specific to SBCS. In recent past, the complication of TASS has become negligible and should not be a major concern in considering SBCS.

Inability to gain information from the first eye

Proponents of DBCS often argue that they gain fruitful information from the first operated eye about the optical correction for the second eye. This advantage is lost if both eyes are operated simultaneously on same day (15,20).

It is known that certain eyes are more prone to have inaccurate biometry measurements. Previous surgeries such as refractive corneal surgery, scleral buckling procedure to treat retinal detachment, and other corneal surface procedures artificially alter the axial length of the eyeball. Similarly, highly myopic eyes with axial length >26 mm and highly hyperopic eyes with axial length <21 mm, or

the eyes with difference of more than 1 mm (one mm) in axial lengths of two eyes are inherently prone to fall out of our formulae to measure accurate power of the IOLs (20). In such extreme cases one can arguably make a point to perform one eye surgery at a time (DBCS) and have the input of information gained from the first surgery.

There are anecdotal arguments not supported by any prospective studies that we gain worthwhile refractive information from the first cataract surgery done as DBCS in routine normal cataractous eyes (63-66). On the contrary, it has been well documented that with the use of present day advanced biometry technology and refinement of IOL power calculation formulae, we can achieve almost the required or target value after routine cataract surgery. It can be translated into that we do not gain significant refractive information from first eye to modify the plans for the second eye after DBCS, therefore, SBCS can be performed under justified circumstances. In a retrospective analysis of 148 eyes operated as SBCS in Finland, as many as 78% of eyes achieved post-operative refraction of ± 0.75 diopter, and 95% of ± 1.5 diopter of the target value (19). Similar results have been reported by another study from India, where 92.5% of 2,470 eyes achieved a target postoperative refraction of ± 0.5 diopter spherical equivalent (44). Addressing this very specific issue, one study determined that the refractive outcome of the first eye was not of value in adjusting the refractive plan of the second eye, where the biometry was based on an ultrasound application method and the difference in axial length between eyes was very large (63). Yet, another study reported that patients undergoing SBCS had postoperative anisometropia of >2.0 diopters in only 1.2% of operated eyes (66).

Bilateral loss of vision

In literature one finds the terms 'loss of vision' (56); that, for me, means or is interpreted as 'blindness'. One has to be careful about the use of terminology. It is better to use the term 'decreased vision' in such instances. Arguments made against SBCS include some rare complications associated with cataract surgery (14,20,32), which are even further rare to involve both eyes simultaneously.

Choroidal hemorrhage, also meaning expulsive choroidal hemorrhage, extremely rare complication, that can happen even today, was associated with large incision cataract surgeries and sudden lowering of intra-ocular pressure by cataract incision in preoperatively undiagnosed and/or uncontrolled glaucomatous patients. It is almost an

unheard-of complication in present literature and there are no predictive factors to watch for this rare complication. The case reports referred to by the opponents of SBCS are from 1950s and 1960s (67-73). It is unrelated with DBCS and/or SBCS. Over and above, if this dreaded complication happens in the first eye then the surgeon should reconsider the operation of the second eye during SBCS.

Retinal detachment-associated with cataract surgery (15) has been used as an argument against SBCS. No documented prospective study has supported this argument that SBCS is more prone to cause bilateral retinal detachment and will not happen in DBCS cases. Not even one eye of 2,470 eyes operated in South India developed retinal detachment (44).

Cystoid macular edema (CME) is a manageable, and in majority of cases self-limiting complication of cataract surgery (15). The risk of CME is increased in as diabetes mellitus, advanced age, uveitis, previous ocular surgeries, and/or complicated cataract procedure etc. (74).

Corneal endothelial decompensation also called pseudophakic bullous keratopathy (15), is associated with advanced age, preoperative low corneal endothelial cell density, prolonged surgery time, complicated cataract surgery, and previous endothelial disorder, example, Fuch's Corneal Endothelial Dystrophy, etc. Careful patient selection and meticulous surgery could avoid and prevent this rare complication in normal regular cataract patients. None of the 2,470 eyes of 1,235 patients operated with SBCS in tertiary care eye center in South India developed this complication (44).

Arguments and considerations supporting SBCS

It is accepted that there is no such urgency or emergency to operate on both eyes of a patient simultaneously to restore vision in both eyes in one sitting. Cataracts do not grow overnight and do not cause total blindness. But for sure, over time they can lead to 'non-functional' vision in both eyes and incapacitate a patient. There is a growing number of ophthalmic surgeons in the 'developing countries' as well as in the 'developed countries' who are performing or want to perform SBCS based on the following factors and reasons supporting SBCS.

Faster visual rehabilitation

Proponents of SBCS support their argument that it helps recover vision in both eyes much faster (7-25) if done

simultaneously rather than delayed or staggered surgery between two eyes (27-48). The indications for cataract surgery in the United States include 'decreased vision affecting life style.' That could be either in the form of losing professional competence, i.e., for a professional driver, a race car driver, a professional musician (unable to read the music-notes), or a surgeon etc., or in the form of inability to follow ones passion of playing music for entertainment or painting for enjoyment etc. Such patients sometimes desperately want to have vision restored bilaterally as quickly as possible. Delayed surgery, especially if staggered by months, could significantly affect lifestyle of such patients for prolonged period of time (7-25). Simultaneous restoration of balanced bilateral vision restores 'normal lifestyle' faster in such patients and is very rewarding (27-48).

There is significant advantage of SBCS in restoring binocularity and stereopsis faster than in patients undergoing DBCS. In normal and almost symmetric optical biometric eyes, the occurrence of 'anisometropia' is very uncommon (40). Visual rehabilitation is particularly important in patients with multifocal IOLs when neuroadaptation process helps patients to learn to use their specific and not physiological optics design in seeing. Thus, SBCS is particularly useful in patients scheduled for multifocal IOLs implantation (75).

Now or Never' situations

Not commonly seen in the 'developed' world, but a very significant argument to support SBCS in the 'developing' world is the factor, we call "Now or Never." In that part of the world some patients go 'functionally blind' because of inaccessibility to medical care. Inability to reach medical facilities, lack of ophthalmic surgeons, lack of transportation, economic reasons, unawareness, physical disabilities, etc. are some of the reasons that these patients lose their functional vision in both eye while waiting for help. If there is a chance to restore vision in such desperate cases, it becomes a 'Now or Never' situation for the second eye. With this argument (7-25) in mind, many ophthalmic surgeons around the world have done SBCS (27-48). One can argue that restoring vision in one eye of such patients should be enough, but then we overlook the fact that binocularity and stereopsis are nature's gift to life, and not confined only to human life. SBCS becomes an important issue in young children born with vision impairing bilateral congenital cataracts. DBCS in such patients exposes them

to develop irreparable amblyopia (62).

Patients requiring general anesthesia

There are patients who require general anesthesia to perform cataract surgery (76,77). Pediatric population, patients with mental and/or physical disability, and uncooperative patients, etc. make a group of patients that will be exposed to the risks and complications of general anesthesia on two different occasions by DBCS. Such patients get SBCS and should be operated on both eyes in one sitting. Most vulnerable to the risks and complications of general anesthesia is the pediatrics population (76,77). Restoration of vision in one eye in an infant or very young child who has bilateral cataracts exposes the second eye to the serious risk of amblyopia, as addressed above (62,76,77). That is a very significant reason to perform SBCS, and has been accepted as a 'standard of care' protocol worldwide.

More and more studies have supported SBCS in pediatric population (76,77). According to the most recent, but retrospective, study of 15 years' experience out of Vienna, Austria, simultaneous removal of bilateral cataract in children showed no statistical significant differences regarding intra- and postoperative complications when compared to unilateral and two-timed bilateral cataract surgery (77). Similar results were observed in a previous study where SBCS was performed in pediatric and adult population without any serious complications feared by the opponents of SBCS (76). If SBCS can be performed and is justified on children then it can be performed and justified on the adults as well; both groups are exposed to the same risks and complications of SBCS.

Economic reasons

Economic reasons are becoming more and more compelling and major factor, especially in the 'developed' world, to support SBCS than DBCS (29,34,37,78). With ever increasing cost of medical care in the 'developed' countries, it is becoming a compounding factor for the medical care providing facilities (hospitals and surgery centers) and for the patients to support SBCS (11,29,34,37,54,78). It has been calculated that SBCS helps lower the costs of surgery for the hospitals and surgery centers, and significantly helps in more efficient and better use of nursing staff and operating rooms than as compared with DBCS (29,34,78). These cost cutting measures, but at the same time not compromising the quality of care, support SBCS whenever

and if possible.

It is not only the providers that benefit economically, it significantly helps the patients as well. Patients return to the work force faster, have half or fewer visits to hospital or surgery centers and to the ophthalmologist offices, lesser co-pays and get one pair of corrective glasses rather than changing lens for the second operated eye as DBCS (11,29,34,37,54,76).

Review of available literature brought to light that only a few studies have calculated the cost-effectiveness or economic benefits of SBCS in numeric. A study comparing cost implications of SBCS versus DBCS in a pediatric population demonstrated 20% reduction in surgical costs per child operated as SBCS when compared with ones done as DBCS; \$274.00 per child for SBCS and \$344.00 for DBCS (78). Similar results were revealed by another study comprised of 520 patients. It showed savings of (Euros) € 449.00 in health care costs and additional savings of (Euros) € 739.00 in travel and 'paid home-care' costs per patient when operated as SBCS. Total costs savings per SBCS patient added up to (Euros) € 849.00; a significant number if taken into account the total number of patients needing cataract surgeries (30). The exact dollar value is difficult to calculate because of numerous variables involved when generalizing for global impact of SBCS versus DBCS. Proponents of SBCS have gone to the extent of calculating that patients expose themselves to 1.5–2.0 times higher risk of death in road accident by more visits to ophthalmologist offices after DBCS than SBCS (16).

One of the reviewers suggested that it would be better to illustrate the exact incidence of endophthalmitis versus anesthesia complications when evaluating the pros and cons of SBCS. On review of available literature, we were able to directly illustrate this very valuable and meaningful comparison. The incidence of early endophthalmitis in all cases of pediatric cataract surgery, not specific to SBCS, was 0.16% over a period of 11 years. During the same period, the incidence of anesthesia related pediatric death was 0.11%; very comparable to incidence of endophthalmitis (78). By subjecting to general anesthesia twice in DBCS we are exposing the infants to twice the risk of drastic complications, including death. In a recent study out of Vienna, Austria, it has been documented that infants and children were more scared, needed longer anesthesia time, and needed more pain medication after DBCS as compared with SBCS (77). Children subjected to SBCS needed prolonged anesthesia time when compared with unilateral cataract surgery, but only by the surgery time needed for

the second eye. The total anesthesia time for SBCS was still shorter than the combined anesthesia time required for two separate procedures performed under DBCS (77). This substantially reduces the risks and complications of general anesthesia by performing SBCS in pediatric and special-need adults. More prospective studies are warranted to evaluate this point that would further substantiate that it is high time to change our thinking and approach to bilateral cataract surgery, and adopt SBCS whenever and wherever it is needed.

Other simultaneous bilateral ocular surgeries

Ophthalmologists around the world perform multiple other ocular surgeries simultaneously on both eyes, sometimes not even changing or resterilizing the equipment. Simultaneous bilateral blepharoplasties, strabismus correction, pterygium removal, etc. are some of the typical examples.

Laser corneal refractive procedures, developed from delayed bilateral into simultaneous bilateral procedures, and interestingly the similar discussion about safety concerns was held in this regard about two decades ago (79-81). This turned the standard laser corneal refractive procedures into simultaneous bilateral procedures conducted in millions of cases in recent years.

Although not very common, some intraocular procedures, such as, simultaneous bilateral trabeculectomies and vitrectomies have been performed as and when indicated without any bilateral complications (49,82-87).

Intravitreal injections (IVI) have become the most common intraocular procedure worldwide with increasing numbers every year (88). In several studies based on bilateral same-day intravitreal anti-VEGF injections, there were no cases of bilateral endophthalmitis, and the overall rate of unilateral endophthalmitis was low and comparable to prior studies of unilateral injections (89,90). The Euretina expert consensus panel recommended to treat each eye sequentially, and not reusing equipment such as the lid speculum or gloves (88).

Guidelines and rules for SBCS

After careful and thorough understanding of the discussion above if one is convinced to accept performing SBCS, then he or she has to follow and obey the rules and guidelines put together by the ISBCS (60). One cannot embark upon SBCS and not follow the *basic principle* of “Treat Each Eye Surgery as Individual, Autonomous, New Procedure.”

Ophthalmic surgeons have been very cautious, may be even over-cautious, from the very beginnings of SBCS. From my personal experiences and from the experiences of other surgeons who had and have done SBCS, I can affirm that surgeons would make every effort to exclude the risk of bilateral infection and endophthalmitis. Careful patient selection, obeying the strict rules of sterilization for each eye, and strict isolation of two operated eyes post-operatively have been the guiding principal during SBCS.

These guiding principal and guidelines now have been formalized and put together by the cumulative experience of multiple surgeons performing SBCS internationally, and are available at www.isbcs.org website.

Here, it is crucial to reinforce a point that there has never been any reported case of simultaneous bilateral endophthalmitis after SBCS when these guidelines were followed and obeyed (40). Most important of these recommendations has been the ‘Rule of Sterility’; each eye and each procedure has to be strictly considered a fresh and new procedure implementing complete sterility. After performing cataract surgery on one eye, the second eye deserves the same sterility and aseptic precautions as the first eye. The gloves, the eye drapes, the surgical gowns and the scrubbing materials etc. must be fresh (25,27,35,91-93). There is no room for ‘cutting corners.’ A second set of ‘sterile operating equipment’ is a must for the second eye. Some surgeons prefer to use irrigation and intracameral solutions, viscoelastics and intraocular lens implants from different batches, with different ‘lot numbers’ and ‘manufacturers’ to avoid dreaded and serious bilateral complications of endophthalmitis and TASS (35).

It should never be considered an over-kill or obsession if it comes to maintaining perfect sterile conditions for simultaneous bilateral procedure; even when it involves extra activities and tasks at the nursing staff level as well as the surgeon (40,93). Some have recommended that the surgery equipment table for the right eye should be to the right side of the patient and a fresh table for the left eye to the left side, making the two tables farther apart from each other, as far as possible, to prevent cross contamination (93). Even better is to organize the second table afresh after completion of the first surgery.

It has become a routine and common practice, at least all over the United States, not only in ophthalmic surgical suites but in general surgical operating rooms as a whole, to have a pre-operative period of ‘Time-out.’ During this ‘time-out,’ preferably the surgeon, otherwise the circulating nurse, has to read out clearly the identity of the patient, the

allergies if present, the diagnosis and the procedure to be performed, and details of the prosthesis (an IOL in case of cataract surgery) to be implanted in the procedure to match with the notes put in the chart by the surgeon. Such steps take little extra time but have much greater benefits to avoid wrongful procedure.

In ophthalmic practice, the details of IOL powers should be clearly marked for each eye and verified by comparing those with patient chart for each eye separately (35). Nursing staff should be trained to read biometric calculations and interpret the data before handing over the IOL from the container box to the surgical technician, and after confirming with the surgeon and his chart notes. If there exists some discrepancy, then it needs to be clarified before proceeding with the procedure.

Even though the patient has consented to SBCS, with an informed written consent, yet surgeon is not bound to perform bilateral surgery in case some serious complication/s occurs in the first eye. Surgeon should use his/her best judgment in such circumstances and defer the second procedure for a later date in the best interest of the patient; not compromising the quality of care.

Bilateral infection remains the foremost concern in SBCS. Careful pre-operative evaluation needs to rule out any potential sources of infection, such as chronic dacryocystitis, lacrimal canaliculitis, infectious blepharitis, chalazion, etc. A mandatory step to reduce bacteria in the wound area is to apply povidone iodine 5–10% to the cornea, conjunctival sac and periocular skin (44,93-96) for a minimum of three minutes prior to surgery, as recommended by AAO and ESCRS. It starts in pre-operative area as the first step performed, even before putting topical anesthetic drops or gel and pupil dilating drops. It is repeated in the operating room before draping each eye with sterile drapes. It is safe, nontoxic and very effective measure to prevent postoperative endophthalmitis and infections and has also been used even to treat endophthalmitis when used in 0.013% to 0.027% concentrations intravitreally (94), without ocular toxicity or TASS.

Careful step-ladder type of clear corneal or limbal incision, especially created with diamond blade, achieves better watertight wound closure to prevent wound leaks and microorganisms entering the eyeball. Metal blades have little more chances of wound leaks than diamond blades (97). Intra-cameral antibiotics have been demonstrated to lower rates of endophthalmitis and should be a routine part of surgery, especially in SBCS cases.

Pre-operative, perioperative and intra-operative

precautions to avoid infection and complications are very crucial. Equally crucial is the post-operative care after SBCS. Patient must wear a protective shield on each eye before bedtime to avoid accidental trauma during sleep, and must have dark or clear protective glasses during day time to prevent accidental self-inflicted or someone else inflicted trauma to operated eye/s. Separate bottles (17) of antibiotics, steroids and/or non-steroidal anti-inflammatory drugs are used for two eyes, and it is important to wash hands when instilling eye drops between two eyes. First two weeks are crucial and strict precautions should be implemented post-operatively. After that the wounds have healed enough that cross-contamination is not a significant risk. Still, precautions should continue for a month to six weeks in cases of SBCS. The role of intracameral antibiotics in preventing endophthalmitis is well documented and its use is also recommended in SBCS (98).

There are other medications and agents regularly used intracamerally during cataract surgery that could expose the operated eyes to the risks of endophthalmitis or TASS. Some come as prepackaged commercially available medicines, but some must be compounded or mixed at the time of surgery there by inheriting the risk of contamination and/or irregular concentrations for intracameral use. Therefore, they deserve special attention especially in cases operated as SBCS.

Conclusions

SBCS has been introduced in the 50ties of 20th century and developed into a mature and safe procedure. Major concerns against SBCS that are still raised are the risk of bilateral endophthalmitis and the risk of postoperative refractive error that could be prevented if surgery of the second eye was delayed. It is well established that when surgeons follow strictly the recommendations of completely separate surgeries (nicely collected by International Society of Bilateral Cataract Surgeons) and use the intracameral antibiotic the risk of bilateral endophthalmitis is so low that can be neglected. The postoperative refractive error can be prevented by following carefully the inclusion criteria for SBCS. Having all these in mind, it is clear that today medical risks do not create a real limitation for SBCS.

On the other hand, governmental regulations, medicolegal implications, economic disincentives, malpractice insurance coverage regulations, etc. are keeping general ophthalmic surgeons from doing SBCS. In places, like Kaiser Permanente Northern California, Ontario

province of Canada, and in some countries such as Finland and Spain, more and more SBCS procedures are becoming a norm because there the regulations support and endorse such procedures. In countries and places where the surgeons are fully compensated for each cataract surgery performed or are on 'capitated' reimbursement, irrespective of SBCS or DBCS, we see an ever-increasing trend of surgeons performing SBCS.

It should be also underlined that with the technological achievements of less invasiveness and more safety in the recent years the simultaneous bilateral procedures were introduced to other fields of ophthalmology. Standard corneal refractive surgeries and intravitreal injections are today conducted as bilateral simultaneous procedures.

We believe that when adhering strictly to inclusion criteria and perioperative recommendations concerning each surgery as a completely separate one, SBCS brings more benefits than threats.

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