

Review article

Pros and cons of immediately sequential bilateral cataract surgery (ISBCS)



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Abstract

Immediately sequential bilateral cataract surgery (ISBCS) is currently a “hot topic” in ophthalmology. There are well-documented advantages in terms of quicker visual rehabilitation and reduced costs. The risk of bilateral simultaneous endophthalmitis and bilateral blindness is now recognized to be minuscule with the advent of intracameral antibiotics and modern management of endophthalmitis. Refractive surprises are rare for normal eyes and with the use of optical biometry. Where a general anesthetic is indicated for cataract surgery, the risk of death from a second anesthetic is much higher than the risk of blindness. A widely recognized protocol from the International Society of Bilateral Cataract Surgeons needs to be adhered to if surgeons wish to start practicing ISBCS.

Keywords: Immediately sequential bilateral cataract surgery, Simultaneous bilateral cataract surgery, Advantages and disadvantages

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<http://dx.doi.org/10.1016/j.sjopt.2016.09.001>

Introduction

Simultaneous bilateral cataract surgery, now more accurately referred to as immediately sequential bilateral cataract surgery (ISBCS) - to clearly differentiate it from delayed sequential bilateral cataract surgery [DSBCS],¹ is still a controversial topic in the ophthalmic world and has to come a long way to become a routine procedure. There have been many positive studies on this subject, and every year surgeons convinced of the benefits of this method join together for discussions and lectures while also attending the meetings of the European Society of Cataract & Refractive Surgeons (ESCRS). Still, the method has as many opponents as supporters.

The aim of this review was to clarify both advantages and disadvantages of ISBCS and a presentation of the necessary measures that should be taken to obtain the best results.

Methods

This is a review study. A PubMed platform search was performed, using the following keywords: bilateral cataract surgery, simultaneous bilateral cataract surgery, sequential bilateral cataract surgery, same-day cataract surgery, bilateral cataract extraction, ISBCS. We found 56 articles of which finally we analyzed 49. English language was preferred, at least for abstracts.

Received 19 October 2015; received in revised form 28 July 2016; accepted 20 September 2016; available online 28 September 2016.

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Definition

What differentiates ISBCS from DSBCS is the timing of the second procedure. Trying to create a definition of ISBCS we should put the greatest emphasis on the words "immediately sequential". It means that the treatment is performed on one patient during one operating session in the operating room, in contrast to DSBCS, where between treatments one and the other eye occur differently with an interval, which may be several days, weeks or months. This means that the patient leaves the hospital after the first eye surgery and returns for the second eye operation. What connects the two surgical definitions is "the independent performance of two separate procedures (autonomy)". Although it may seem obvious with DSBCS, this also applies to ISBCS - both treatments should be carried out with complete change of drape, appliances, and irrigation fluids.

History

One of the earliest scientific reports of simultaneous binocular cataract in one operating session comes from 1952.² Initially this applied to ICCE operations. Over the years, surgical techniques were refined and supporters of ISBCS appeared. ISBCS began to become common with the advent of small incision Phaco, although there are some places that do it with manual small incision cataract surgery (MSICS) now as well.

In Poland, even though there are a few surgeons who operate simultaneously both eyes, there are few documented cases of such operations. In the identified publications, we discovered that in the period from January to December 1985, 48 operations by cryoextraction were performed, and from March to June 1999 3 treatments of ISBCS were performed,^{3,4} all due to the health of the patients requiring surgery under general anesthesia. The operation of each eye was treated as a separate procedure, and all were run under strict aseptic conditions. In none of these cases there were early or late postoperative period complications observed.

In 2009, 10% of responding members of the ESCRS were performing ISBCS.^{1,5} The leading country for the proportion of ISBCS done is Finland. Routine ISBCS has been common there since 1996, and many hospitals currently perform ISBCS on 40% to 60% of cataract patients.^{1,6} Spain's region of the Canary Islands perform 80% of all cataract surgeries in this way with explicit government approval, which recently concluded that "ISBCS, as a surgical alternative for cataract patients, is as safe and effective as conventional DSBCS".⁷ In the Canadian province of Ontario, ISBCS has increased from 1.02% of total cataract surgeries in 2003/2004 to 2.36% in 2009/2010, with a 40% increase in total provincial cataract surgical volume over the same period. Thus, there has been a consistent increase in the performance of ISBCS in Ontario, over the 7 years from 2003 to 2010, a pattern similar to what is currently seen worldwide. Australia was similar to Canada in that it practices a fee-for-service reimbursement with simultaneous second-eye discounts of 50%. In contrast to report on ESCRS member activities, the American Academy of Ophthalmology does not endorse simultaneous procedures due to potential serious complications, such as endophthalmitis and poorer refractive outcomes, that are considered to be associated with the technique.⁸ As such,

DSBCS remains the standard of care in the United States, and ophthalmologists face financial penalties for performing ISBCS.^{9,10} In Israel and Japan, ophthalmologists receive no reimbursement for the second simultaneous bilateral cataract surgery. In the United Kingdom, ophthalmologists received 80% of the first-eye fee for the second eye in simultaneous bilateral cataract surgery¹¹ from some insurance providers, but more often only 40%.

Qualification and precautions

A fundamental and overriding principle that should be followed is to treat each eye surgery as individual and autonomous, as recommended by the International Society of Bilateral Cataract Surgeons (www.isbcs.org). It should be noted that there have never been any reports of bilateral simultaneous endophthalmitis if these recommendations are followed. This applies primarily to the strict aseptic separation. Each eye requires an absolute change of covering, staff's gloves, gowns and instruments.¹²⁻¹⁶ Many authors emphasize that the instruments should come from different sterilization cycles and substances used during the procedure, such as viscoelastics or irrigation fluid, if possible, should be from different companies or at least different lots.¹⁴ Thus there are hidden extra activities in practicing safe ISBCS compared to DSBCS, and nursing tasks and responsibilities are subtly increased. Some operating suites are arranged so that an operator always do left eyes first. The left eye can be done farther away from the preparation of the table for the right eye than vice versa in that kind of arrangement of operating room.¹⁵

Information of right and left eye intraocular lens (IOL) and astigmatism has always to be clearly marked, so that it can easily be seen by the surgeon and all staff. Nurses should be trained to read and interpret biometric data, which they read out loud as they pass the IOL from the circulating table to the scrub nurse, confirming IOL choice.¹⁴ If any significant surgical problem remains unresolved with the first eye, consideration should be given to deferring the second surgery.¹⁷

Another requirement of successful ISBCS is to prevent the development of infection: this is because opponents cite the risk of bilateral simultaneous endophthalmitis as the main reason against undertaking ISBCS. Great emphasis should be put on prophylaxis that starts with the surgery and continues through the postoperative period. Intracameral antibiotic prophylaxis was shown to reduce the rate of endophthalmitis, as does a well-sealed incision, and non-complicated cataract surgery.¹⁸

There is no doubt that metal blade incisions are not as smooth as diamond blade incisions and leak more frequently, setting up an environment in which microbes have access to the anterior chamber,¹⁹ and we therefore prefer diamond blades. Which antibiotic is right to use intracamerally is widely discussed, but there is little doubt that intracameral antibiotics are recommended for ISBCS.

The only RCT study and majority of retrospective case series were based on cefuroxime use. Its limitations, however, are well known and they include complete lack of activity against Enterococci, Pseudomonas species and Enterobacteriaceae species enterococci, low activity against methicillin-resistant *S. Aureus* (MRSA) and *S. Epidermidis* (MRSE) and increasing resistance of CoNS. It was shown in a Swedish

prospective epidemiological study based on 464,996 operations that Enterococci and coagulase-negative Staphylococci (CoNS) were responsible for 57% of endophthalmitis cases.²⁰ This was recently confirmed in a retrospective review of 692,786 surgeries.²¹

Moreover, it was recently suggested that that these infections occur as a result of selection after cefuroxime intracameral use, when the sensitive strains are killed by the prophylaxis, whereas the resistant strains remain and proliferate.²¹ The same National Cataract Registry reveals that the practice in same day bilateral surgery in Sweden is to add 100 µg ampicillin to the 1 mg cefuroxime dose, because of its activity against enterococci.²¹

Vancomycin, although potent against these organisms and most other Gram-positive bacteria, should be used in prophylaxis only in justified situations. The US Centers for Disease Control's Hospital Infection Control Practices Advisory Committee has recommended that "the use of vancomycin should be discouraged" in situations, including "routine prophylaxis other than in a patient who has a life-threatening allergy to beta-lactam antibiotics". It is generally believed that the use in prophylaxis of this potent and indispensable antibiotic against multiresistant strains will eventually lead to loss of its activity. Moreover, it was shown recently that post-operative hemorrhagic occlusive vasculitis might be associated with intracameral vancomycin use.^{22,23}

This might be of special concern since the entity may not be present for several weeks, by which time both eyes have undergone cataract surgery.

Moxifloxacin has a broader spectrum of activity against common endophthalmitis pathogens and less reported bacterial resistance than cefuroxime, shows dose-dependent rather than time-dependent kinetics, antinuclear efficacy, and a low risk for allergy and is the simplest to prepare, making dilution errors unlikely.^{15,24,25} Nevertheless, category 1 data (randomized prospective trial data published in peer-reviewed journals) exists only for cefuroxime.²⁶

The important period of risk for infection is immediately after surgery. When the commencement of topical antibiotics is delayed, the risk for infection greatly increases.²⁷ We recommend that patients' eyes is not patched post-surgery, but rather topical eyedrops have to be commenced immediately after the procedure in high doses.

At present, according to ESCRS 2013 guidelines, the drug of choice in the treatment of infections caused by MRSA / MRSE is vancomycin but it is not recommended in prophylactic use. Vancomycin should be reserved only for therapeutic applications, especially endophthalmitis after cataract surgery. Currently moxifloxacin is considered by many to be the most appropriate unpreserved antibiotic eye drop to use in post-cataract surgery period.²⁸

We propose the use of topical drops 6 times a day for the first 3 days and then 5 times a day for next 3 days. The patient should ideally be instructed to use different bottles for each eye.²⁹

With the advent of Femto Laser-Assisted Cataract Surgery (FLACS) there is a special conundrum for ISBCS. It is clearly more efficient to use the Femto laser on both eyes immediately one after the other, but then one is committed to bilateral surgery, even if there is a serious surgical complication with the first eye surgery. If only one eye has FLACS before doing the femto incisions on the second eye,

a second visit to the laser room will be required with loss of efficiency. The exact protocol for FLACS-ISBCS is currently in evolution (Table 1).

Objections

It seems to us that the objections against ISBCS are primarily based on anecdote rather than published data.³⁰ After a systematic literature search, there were three randomized controlled clinical trials (RCTs) found, including a total of 1900 patients. However, even though there were only randomized trials included, the level of evidence was low to moderate. Thus, there is no strong scientific background to advice against or in favor of ISBCS according to the authors of one publication³¹ although it is not clear what benefit they were expecting. Furthermore, as Bjorn Johansson (personal communication) has elegantly pointed out, how could one do a double-masked trial of ISBCS versus DSBCS? We are aware that there are claims that obtaining the refraction from first eye cataract surgery allows improved outcome for second eye surgery, but these claims have not been supported by prospective trials. The introduction of optical biometry which has improved the predictability of optical outcomes for normal eyes (those requiring IOLs in the +15 to +25 range) and the guidelines of the International Society of Bilateral Cataract Surgeons minimize the risk of refractive surprises which should in any case be mentioned as part of obtaining informed consent.

The most serious allegations against the ISBCS are the risk of potential bilateral vision loss as a result of bilateral complications³² such as endophthalmitis, TASS, CMO or even refractive surprises. The most severe of these is endophthalmitis; however, there are also theoretical risks of choroidal hemorrhage, corneal decompensation, cystoid macular edema and retinal detachment.^{33–35} Some authors divide late complications into 'catastrophic' and 'non-catastrophic'. The first one includes fungal endophthalmitis and epithelial ingrowth whereas non-catastrophic complications include cystoid macular edema and corneal decompensation.^{36,37}

One more complication that is sometimes mentioned is toxic anterior segment syndrome (TASS), which is a sterile inflammatory reaction that usually occurs when something is changed in the surgical protocol—the source of balanced salt solution, brand of gloves used, instrument cleaning detergents or methodology.^{5,38} The use of prepared intracameral antibiotics should help to reduce this risk by minimizing errors in mixing and diluting antibiotics in the perioperative period.¹⁰ Similarly the guidelines of the International Society were specifically designed to minimize this risk which unlike endophthalmitis (which should be a random chance event) represents a preventable system failure.

The greatest fear about ISBCS is bilateral simultaneous endophthalmitis, despite bilateral endophthalmitis being well described in cases of DSBCS. There have been 4 cases of simultaneous bilateral endophthalmitis reported in the world literature and none of the operations were done according to the protocol published by the International Society of Bilateral Cataract Surgeons.^{19,39–42} In practice, it means that aseptic rules were broken^{5,43} and when safety rules are not respected we should not be surprised to hear of bad outcomes.

Table 1. iSBCS general principles for excellence in ISBCS 2009.

1. Cataract or refractive lens surgery should be indicated in both eyes
2. Any concomitant relevant ocular or periocular disease should be managed
3. The complexity of the proposed ISBCS procedure should be easily within the competence of the surgeon
4. The patient should provide suitable informed consent for ISBCS, being free to choose ISBCS or DSBCS
5. The risk for Right – Left eye errors should be minimized by listing all surgical parameters (selected IOL, astigmatism, etc.) for both eyes on a board visible to all in the operating room (OR), at the beginning of each ISBCS case. The WHO operative checklists should also be used if possible^a
6. Intraocular lens power errors are minimized by having OR personnel familiar with the calculation methods used. The original patient charts should be available in the OR, and everybody passing the IOL to the surgical table should confirm the IOL choice. ISBCS nursing staff should be specifically trained and experienced
7. Complete aseptic separation of the first and second eye surgeries is mandatory to minimize the risk of post-operative bilateral simultaneous endophthalmitis (BSE)
 - a. Nothing in physical contact with the 1st eye surgery should be used for the 2nd
 - b. The separate instrument trays for the two eyes should go through complete and separate sterilization cycles with indicators
 - c. There should be no crossover of instruments, drugs or devices between the two trays for the two eyes at any time before or during the surgery of either eye
 - d. Different OVDs, and different manufacturers or lots of surgical supplies should be used, whenever reasonable (where the device or drug type has ever been found to be causative of endophthalmitis of toxic anterior segment syndrome) and possible (if different lots or manufacturers are available) for the Right and Left eyes.
 - e. Nothing should be changed with respect to suppliers or devices used in surgery without a thorough review by the entire surgical team, to assure the safety of proposed changes
 - f. Before the operation of the second eye, the surgeon and nurse shall use acceptable sterile routines of at least re-gloving after independent preparation of the second eye’s operative field
 - g. Intracameral antibiotics have been shown to dramatically reduce the risk of post-operative endophthalmitis. Their use is strongly recommended for ISBCS
8. Any complication with the first eye surgery must be resolved before proceeding. Patient safety and benefit is paramount in deciding to proceed to the 2nd eye
9. ISBCS patients should not be patched. Post-operative topical drops are most effective immediately post-operatively and should be begun immediately post-op, in high doses, which can be tapered after the first few days. Other ophthalmic medications (e.g. for glaucoma) should be continued uninterrupted
10. ISBCS surgeons should routinely review their cases and the international literature to be sure that they are experiencing no more than acceptable levels of surgical and post-operative complications. Membership in the International Society of Bilateral Cataract Surgeons (www.iSBCS.org) is highly recommended to keep abreast of the latest ISBCS information

^a Haynes et al. 59.

In the ESCRS prophylactic intracameral cephalosporin studies, the incidence of postoperative endophthalmitis after unilateral cataract surgery weight-averaged to 1 in 331 (0.3%) without prophylactic intracameral antibiotics and to 1 in 1977 (0.05%) with prophylactic intracameral antibiotics (1), whereas studies in the United States using only topical antibiotics reported infection rates as low as 0.028%. (1) No bilateral simultaneous endophthalmitis occurred in the 95,606 ISBCS cases collected. (1) The overall rate of postoperative endophthalmitis after ISBCS was 1 in 5759. (1) Infection rates were significantly reduced with intracameral antibiotics to 1 in 14,352 cases.¹ The Swedish national study of the country’s endophthalmitis rates from 2005 through 2010 (464,996 surgeries) showed an infection rate of 0.029%, lower than that of the ESCRS endophthalmitis study (0.062%).^{10,44} The risk for postoperative endophthalmitis in ISBCS appears to be at least as low as and possibly lower than published rates for unilateral surgery, particularly when recommended precautions are taken. Intracameral antibiotics significantly reduced the risk for postoperative endophthalmitis.¹ Furthermore, critics often equate bilateral endophthalmitis with bilateral blindness which is not credible with modern therapy where approximately 1/3 of eyes regain near-normal vision.¹⁰

Another disadvantage quoted by opponents of ISBCS is that there is no possibility to plan the operation of the second eye on the basis of the results of the first operation³³ notably with respect to the optical outcome. On the one hand, we know that what increases risk of inaccurate biometry is as follows: high myopia or axial length >26 mm, high hyperopia or axial length <21 mm, axial length difference between the eyes >1 mm, or previous refractive surgery.³⁶ On the other hand, none of the randomized controlled clinical trials could

provide evidence as to the prevalence of postoperative anisometropia in patients undergoing ISBCS.³¹ Undertaking certain eligibility criteria and careful patient selection may solve this problem. However for “normal” eyes, optical biometry is so predictable that this disadvantage is more theoretical than that of any real clinical relevance.

A further criticism of ISBCS is that to date it has only been practiced by the so-called elite surgeons. This seems to imply that if more “average” surgeons were to undertake ISBCS we would see more problems. The implication seems to be that there are surgeons who would not follow safety guidelines, but we are not aware of any evidence to support this. It

Table 2. Cases of bilateral endophthalmitis.

| Reference | Patient (age/sex) | Risk factors | Vision after recovery |
|-----------------------------------------|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|
| Benezra and Chirambo ³⁹ | No data | Septicemia and dysentery at the commencement of cataract surgery, and the same instruments were used in both eyes without resterilization | Perception of hand movements |
| Ozdek et al. ⁴⁰ | 70/male | The same irrigating fluids, flash sterilization of the same instruments, and no antibiotic prophylaxis | 20/50 and 20/40 |
| Kashkoui et al. ⁴¹ | 67/male | Same instruments in both eyes | Visual loss |
| Puvanachandra and Humphry ⁴² | 81/ female | Instruments from the same flash cycle, antibiotic of high incidence of resistance | 6/9 bilaterally |

Table 3. A comparison of costs of single surgery DSBCS and ISBCS.

| Reference | Study group | Cost type | DSBCS | ISBCS |
|------------------------------|--------------|--------------------------------------------------|------------|------------|
| O'Brien et al. ⁴⁹ | 22 Patients | Total hospital cost | 1566,3 CAD | 1059,1 CAD |
| Leivo et al. ⁵⁰ | 520 Patients | Hospital standard care | 2376 € | 2144 € |
| Rush et al. ⁵¹ | 42 Patients | Total ambulatory surgery center costs | 767 USD | 856 USD |
| | | Total cost for the 3rd-party payer for both eyes | 4067 USD | 3123 USD |

CAD - Canadian dollar.

seems self-evident that any surgeon who wishes to undertake ISBCS should be aware of the International Society suggestions, and follow them (Table 2).

Advantages

The undoubted and greatest medical advantage of ISBCS is the faster complete visual rehabilitation of the patient.⁴⁴ Single eye surgery causes a reduction in our visual system from two receptors to one. Second eye surgery restores a normal balanced visual system for the patient, something that nature has validated for millions of years.^{14,45}

The operation prevents also other significant problem occurring after unilateral surgery - anisometropia. Some authors consider A-scan measurements to be inaccurate to allow ISBCS. Experience of the clinics which carried out thousands of such treatments shows that after simultaneous binocular surgery minor errors occur and they are almost always symmetrical and do not cause problems such as anisometropia.⁴⁶ Even if there is a small lapse from a target refraction, the stereoscopic vision is immediately restored.

Furthermore, ISBCS is an ideal solution for patients who require general anesthesia, because it obviously lower the risk of a second anesthetic with associated risks.^{10,47,48}

A second major advantage of ISBCS is economic - there are lower hospital costs, more efficient use of operating room time and more efficient use of clinic.^{6,11,49-52} There are also financial advantages for the patient: faster return to work, fewer hospital visits and only one pair of new glasses needed.^{27,36,53,54} Surprisingly, calculation has been carried out that there is potentially 1.5-2 times higher risk from death in a road traffic accident by undergoing extra visits for unilateral sequential cataract surgery in those suitable for ISBCS⁵⁵ (Table 3).

Conclusion

With the development of surgical techniques, better equipment, and modern medicines, ophthalmic surgeries are faster, and have lower risk of complications and shorter hospitalization time. With these achievements we gain the courage to cross new boundaries, and one of them is the adoption of ISBCS for suitable cases. With careful patient selection^{38,56,57} and strict adherence to protocol, this is a method with minimal risk of binocular blindness.¹⁰ However, what we need for full success is an experienced, skilled surgeon.⁵⁸ All this adds up to the fact that the operational risk for ISBCS is the same or even smaller than DSBCS.⁴⁰ We hope that soon it will become a standard in many clinics.

Conflict of interest

The authors declare that there are no conflict of interests.

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