

## Simultaneous versus sequential surgery for bilateral congenital cataracts in a resource-limited setting

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### Abstract

**Background:** To compare simultaneous surgery with sequential surgery for the treatment of bilateral congenital cataracts in children younger than three years at a tertiary hospital in a resource-limited setting in order to facilitate informed decision-making by parents and healthcare providers.

**Methods:** A retrospective review of medical records of children below three years who had bilateral surgery for congenital cataracts between 2010 and 2016 at the paediatric ophthalmology unit of a university teaching hospital in Nigeria. Data on demographic characteristics, type of surgery, delays in care, time interval between surgery and optical rehabilitation, direct cost of care, systemic associations and surgical complications were retrieved, descriptively summarized and compared for both groups.

**Results:** There were 40 eligible patients, 25 (62.5%) of which were males. Age at presentation ranged from 4-128 weeks with a median of 28 weeks. Twenty-four (60%) patients had simultaneous bilateral cataract surgery. Patients who underwent sequential cataract surgery had higher direct costs and accumulated hospital stay, and were more likely to experience delays in accessing second procedures as well as post-operative optical rehabilitation. No anesthetic or other serious ocular complications such as endophthalmitis were noted in either group.

**Conclusion:** Although there were similarly low complication rates in both groups, we observed higher direct costs of care, longer duration of hospital stay, as well as longer intervals before second surgeries and visual rehabilitation in the sequential group. Therefore, simultaneous cataract surgeries may be the preferable option in resource-limited settings like ours, where health care financing is mainly through out-of-pocket expenses.

**Keywords:** *Congenital cataract, simultaneous surgery, sequential surgery*

### Résumé

**Contexte:** Pour comparer la chirurgie simultanée avec la chirurgie séquentielle pour le traitement des cataractes congénitales bilatérales chez les enfants de moins de trois ans dans un hôpital tertiaire d'un environnement à ressources limitées afin de faciliter la prise de décision informée par les parents et les fournisseurs de soins de santé.

**Méthodes:** Examen rétrospectif des dossiers médicaux d'enfants âgés de moins de trois ans ayant subi une chirurgie bilatérale pour une cataracte congénitale entre 2010 et 2016 à l'unité d'ophtalmologie pédiatrique d'un hôpital universitaire au Nigéria. Les données sur les caractéristiques démographiques, type de chirurgie, délais des soins, intervalle de temps entre la chirurgie et la réadaptation optique, le coût direct des soins, les associations systémiques et les complications chirurgicales ont été récupérées, résumées de manière descriptive et comparées pour les deux groupes.

**Résultats :** Il y avait 40 patients éligibles, dont 25 (62,5%) étaient des garçons. L'âge à la présentation variait de 4 à 128 semaines avec une médiane de 28 semaines. Vingt-quatre (60%) patients ont subi une chirurgie bilatérale simultanée de la cataracte. Les patients subissant une chirurgie séquentielle de la cataracte entraînaient des coûts directs plus élevés et une hospitalisation cumulée, et étaient plus susceptibles d'avoir des retards dans l'accès à une seconde procédure ainsi que dans la rééducation optique postopératoire. Aucune complication anesthésique ou autre complication oculaire grave telle que l'endophthalmie n'a été notée dans les deux groupes.

**Conclusion:** Bien que les taux de complications soient tout aussi faibles dans les deux groupes, nous avons observé des coûts directs plus élevés des soins, une durée d'hospitalisation plus longue, ainsi que des intervalles plus longs avant la deuxième intervention chirurgicale et la réadaptation visuelle dans le groupe séquentiel. Par conséquent, les chirurgies de la cataracte simultanées peuvent être l'option préférable dans des environnements aux ressources limitées comme le nôtre, où le financement des soins de santé repose principalement sur les dépenses personnelles.

**Mots clés:** *Cataracte congénitale, chirurgie simultanée, chirurgie séquentielle*

## Introduction

Globally, approximately 1.4 million children are blind [1]. Childhood blindness requires special attention because of its significant contribution to "blind person years"[2]. Congenital cataract currently constitutes the leading cause of childhood blindness in Africa [3]. It occurs in 1 in 30,000 live births and is bilateral in two-thirds of cases [4].

The definitive management for congenital cataract is surgery. The management of cataracts in the paediatric age group is multidisciplinary, challenging and requires long term follow-up. It also has certain peculiarities as regards timing and type of surgery, because of the risk of stimulus deprivation amblyopia [5].

There is a global controversy on whether bilateral cataract surgeries should be carried out sequentially (each eye on a different day) or simultaneously (both eyes during the same theatre session) [6-9]. For instance, simultaneous surgeries may be associated with higher risk of endophthalmitis or Toxic Anterior Segment Syndrome (TASS) [6,10,11]. These risks may be circumvented by adhering strictly to aseptic procedures and treating each eye as a separate entity [12]. Despite these limitations, the advantages of simultaneous surgery in children include less exposure to general anaesthesia, faster visual rehabilitation, avoidance of loss to follow-up for second surgery and/or rehabilitation, and lower overall costs to the patient [12-15].

There are no studies from sub-Saharan Africa addressing this controversy. Therefore, this study compared simultaneous and sequential bilateral congenital cataract surgery at a tertiary hospital in Nigeria in order to assist paediatric ophthalmologists and parents/care-givers in informed decision-making.

## Patients and methods

The study was a retrospective comparison of simultaneous and sequential bilateral cataract surgeries for bilateral congenital cataracts in children younger than three years at the paediatric ophthalmology unit of our hospital between January 2010 and April 2016. Outcome measures included length of hospital stay, direct costs, occurrence of complications (anaesthetic complications, endophthalmitis, TASS) and delays in care. The direct cost for each group comprised three main parameters- cost of surgery, cost of accommodation and cost of drugs.

All patients were referred for paediatric cardiology review to ascertain fitness for general

anaesthesia before being scheduled for surgery. Careful and detailed ocular examination was carried out to rule out the presence of risk factors for endophthalmitis such as conjunctivitis, blepharitis, nasolacrimal duct obstruction, etc. Caregivers were appropriately counseled on both surgical modalities, and allowed to make an informed decision. There was strict adherence to aseptic technique during surgery. Each eye was treated as a separate entity for the simultaneous group, with surgeons and assistants re-gowning and re-scrubbing before operating on the second eye, and the use of a separate set of instruments. Surgeries were performed under general anaesthesia by three different surgeons, all of whom are trained paediatric ophthalmologists.

Most patients had Extracapsular Cataract Extraction (ECCE) with Primary Posterior Capsulotomy (PPC) and Anterior Vitrectomy (AV) through the limbal approach. Two patients had Small Incision Cataract Surgery (SICS) and lens aspiration respectively. There was no intraocular lens implantation for any of the patients. Incisions were closed with 10/0 monofilament nylon sutures. All patients received subconjunctival methylprednisolone, dexamethasone and gentamicin at the end of surgery before padding the eye. This was followed by frequent instillations of topical antibiotic and steroid eye drops post operatively. Optical correction was by use of spectacles or contact lenses depending on availability and affordability.

Surgery for the second eye in the sequential group was routinely scheduled for one week after surgery in the first eye. All patients were scheduled to have refraction a few days after surgery, while still on admission. This was the definitive refraction used as a basis for optical rehabilitation for the simultaneous group. The patients in the sequential group were scheduled to have a second refraction (definitive) few days after surgery in the second eye. Patients were closely monitored for complications, adherence to medications and commencement of optical rehabilitation as much as possible.

Data was analysed using IBM Statistical Package for Social Sciences (SPSS) version 20.0 (IBM Corps., New York, USA). Means and standard deviations were calculated for quantitative variables while frequencies and percentages were calculated for qualitative variables. The difference in mean hospital stay, direct costs and delays in management for the two groups were compared using the Independent t-test, and a *P*-value of <0.05 was considered statistically significant.

The study abided by the tenets of the Declaration of Helsinki for studies involving human

subjects. Ethical approval was obtained from the Ethics Review Committee of the hospital.

**Results**

Prior to 2012, mostly sequential surgeries were performed, while the rate of simultaneous surgeries increased thereafter (Figure 1). Forty of 42 eligible patients had complete data and were included in the study. Median age at presentation was 28 weeks (range 4-128 weeks) and 25 (62%) of them were males. Twenty-five (62.5%) patients had associated cardiac abnormalities and 24 (60%) patients had simultaneous surgery.

There was no significant difference in gender distribution between both simultaneous and sequential surgery groups [p= 0.505]. The median ages in both groups were also not significantly different, p=0.29. However, more patients in the simultaneous group had systemic associations (83.3%) compared with patients in the sequential group (31.2%); [p= 0.001].

Patients who had sequential surgeries had significantly longer hospital stay and higher direct costs than patients who had simultaneous surgeries

(table 1). Twelve (75%) of patients in the sequential group had surgery in the second eye within seven days of surgery in the first eye. Three patients in this group, however, experienced delays accessing surgery in the second eye ranging from four to twelve months, while one patient was lost to follow-up before second surgery. Specific reasons for the delay in these patients were not available in their records. Definitive optical correction for all patients was achieved after cataract surgery had been carried out in both eyes. As a result, the three patients who had delay in accessing surgery for the second eye invariably had delays in visual rehabilitation. No serious anaesthetic or ocular complication (endophthalmitis or TASS) was noted in the two groups.

**Discussion**

The main finding of this study was that while the sequential group had higher direct costs, longer duration of hospital stay, longer intervals to second surgery and visual rehabilitation, there were no anaesthetic or serious ocular complications (endophthalmitis or TASS) in either group.

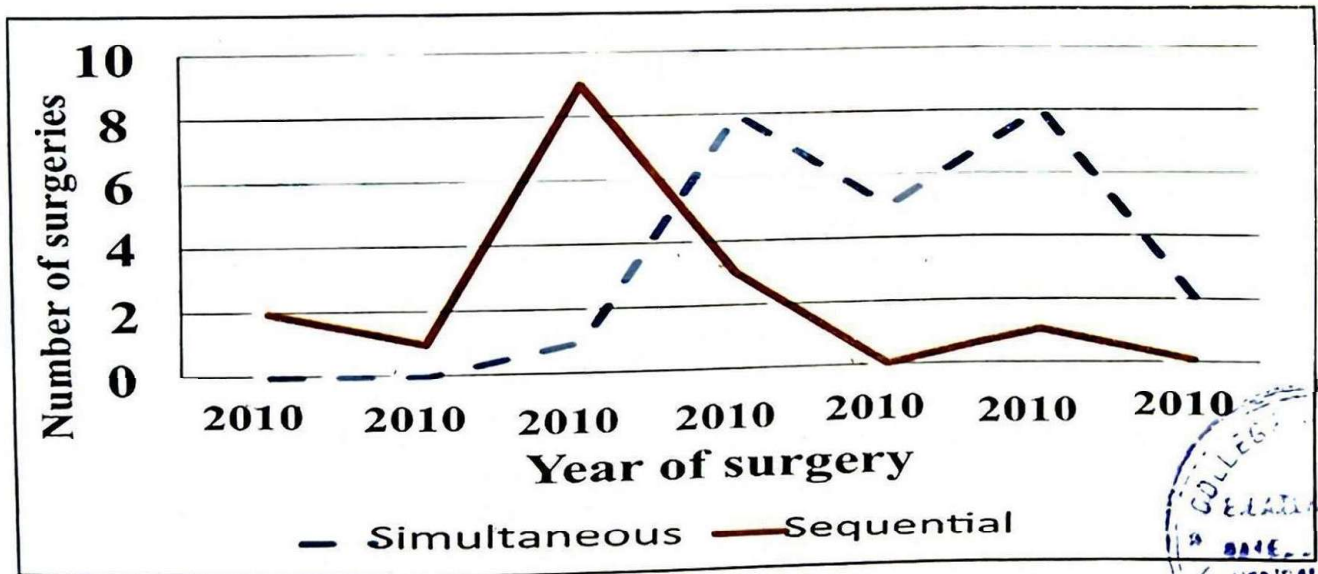
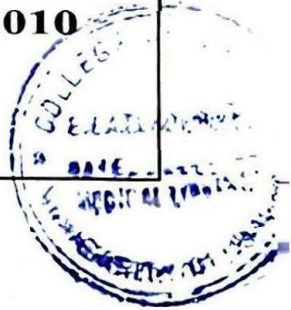


Fig. 1: Trend of bilateral cataract surgeries in the hospital between January 2010 and April 2016

Table 1: Comparisons between simultaneous and sequential surgery for bilateral congenital cataract

	Simultaneous surgery	Sequential surgery	P-value (difference in mean/median)
Length of hospital stay	Mean = 6.3 days (4-10 days)	12.1 days (11-18 days) >> 92% longer	P<0.001
Direct costs	Mean = ₦47,000 (₦45,200 - ₦52,200)	Mean = ₦70,000 (₦69,000 - ₦73,000) >> 48.9% higher	P<0.001
Time interval-surgery to optical correction	Median = 2.25 days (1-5 days)	Median = 9 days (8-365 days)	P=0.076



Previous studies showed similar safety and efficacy profiles for both types of surgery [7,14,15]. The main arguments against simultaneous surgery are the rare but devastating risks of bilateral endophthalmitis and TASS. However, there are only four documented cases of bilateral endophthalmitis following simultaneous bilateral cataract surgery in literature, all occurring following a breach of standard protocol, and there is no documented case of bilateral TASS [7]. The incidence of acute-onset endophthalmitis following cataract surgery has been reported to be 0.04% [16] and the incidence following paediatric intraocular surgery is 0.071% [17]. Although the fact that there were no cases of endophthalmitis or TASS in this study may be due to the small sample size, it is important to note that the rates of endophthalmitis and TASS in the Paediatric Ophthalmology unit of our hospital have been 0% respectively in the last 10 years. Nevertheless, careful patient selection and maintenance of strict aseptic technique (re-gowning and re-gloving, using different set of instruments, different batch of balanced salt solution and viscoelastic agents) are the bedrocks of safe and effective simultaneous surgery.

The risk of repeated exposure to general anaesthesia is one of the arguments against sequential surgeries. Specifically, the associated cardiac and systemic comorbidities in some of the children with congenital cataracts make them poor candidates for repeated exposure to general anaesthesia. In this study, more than half of the patients had associated cardiac morbidities. Though recent evidence has shown no significant association between a single, short duration exposure to general anaesthesia and future neurocognitive and behavioural outcomes [18], there is no evidence yet with regards to the effect of multiple exposures in vulnerable subjects such as these.

Patients who had sequential surgery had total direct costs that were 48.9% higher than patients who had simultaneous surgery. Other studies in the United States and Finland have also reported higher costs for sequential surgeries [13,15,19,20]. Simultaneous surgeries may be more cost effective in our setting in view of the challenges of health care financing which is mostly through out-of-pocket spending on the part of caregivers.

In addition, patients who had simultaneous surgeries in this study spent fewer days in the hospital and were less likely to experience management delays than patients in the sequential group. This is also similar to findings in other studies [13,15], and is an incentive for choosing simultaneous over sequential surgery.

The main limitation of this study is its retrospective nature and the possibility of bias due to lack of randomisation into the two surgery groups. A randomised controlled trial would have been ideal to affirm the evidence from this study regarding the advantages of simultaneous over sequential surgery. Another limitation is that the study did not compare visual outcomes, long term complications as well as compliance with follow up.

In conclusion, the choice of simultaneous over sequential surgery for bilateral congenital cataracts is dependent on various important factors such as available resources, expertise and patient factors. Based on the results of this study and evidence from literature, simultaneous surgery may be considered as the preferable option for bilateral congenital cataracts especially in resource-limited settings where access to health care is inadequate and the burden of health care financing is borne mostly by the patient/caregiver.

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