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Original Article

Intraoperative Complications of Posterior (Forceps) Capsulorhexis in Pediatric Cataract Surgery through Anterior Approach

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ABSTRACT

Pediatric cataract surgery often involves a posterior capsulorhexis with forceps to prevent posterior capsule opacification, but it is associated with intraoperative complications such as vitreous loss, anterior hyaloid damage, and zonular dehiscence, which require meticulous surgical skill to manage effectively. **Objective:** To determine Intraoperative complications encountered during posterior (forceps) capsulorhexis in pediatric cataract surgery through anterior approach. **Methods:** This prospective cohort study was comprised up on 50 peadiatric patients having congenital cataract with age up to 12 years who presented at the study setting included in the. Data were analyzed using SPSS 26.0. **Results:** The study had 52% population as male while 48% were female, with 58% were right eyes 42% were left eyes. Anterior chamber was collapsed in 14 eyes (28%) after initial paracentesis incision while 36 eyes (72%) maintained original position. Forward bulge of posterior capsule was present in 36% of eyes while in 64% forward bulge was absent. Vitreous thrust was found in 38% cases while in 62% there was no vitreous thrust. Clearance of anterior vitreous face was done in 42 eyes (84%). **Conclusions:** We found that performing posterior capsulorhexis in pediatric cataract surgery through anterior approach is a safe procedure and encountered posterior capsular bulging and vitreous thrust as the most common complications.

INTRODUCTION

Cataract, characterized by the opacification of the crystalline lens, leads to significant visual disturbances. In pediatric patients, this condition can severely impact education, quality of life, personality development, and career opportunities, thereby increasing the socioeconomic burden on families and communities [1]. Childhood blindness due to cataract is one of the major devastating avoidable causes of blindness in both developed and under-develop countries [2]. Cataract is one of significant cause of childhood blindness in all countries [3]. Pediatric cataract is a significant preventable cause of visual impairment in children, particularly in developing countries, where it negatively impacts national growth. Each year, an estimated 500,000 children worldwide become blind, with 75% of childhood blindness in these regions being preventable or treatable. [4]. Timely detection and appropriate management by skilled ophthalmic surgeons enhance the visual outcomes of pediatric cataract surgery, which is vital for optimal visual development and preventing amblyopia [5, 6]. In developing nations, cataract is responsible for 12% to 39% of childhood blindness, with India at the lower end and Jamaica at the higher end of this range [4]. In contrast, the incidence of congenital cataract in the UK has been calculated at 2.49 to 3.46 per 10,000 [7]. Reasons for increased incidence of congenital cataracts in developing countries are miscellaneous, like over population, inter family marriages, early age conception, malnutrition, lack of medical facility and lack of awareness. Congenital cataracts are commonly diagnosed at birth. If a cataract goes undetected in an infant, permanent visual loss may ensue [8]. Managing congenital cataract differs from adult

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cataract in several ways, including ocular anatomy, cataract morphology, and the occurrence of Posterior Capsular Opacification (PCO) after surgery, the necessity for amblyopia therapy, and the selection of Intraocular Lenses (IOLs). Additionally, the management of the anterior and posterior capsules often requires anterior vitrectomy to prevent PCO. Studies have reported PCO rates ranging from 50% [9, 10] to nearly 100% [11, 12] if the posterior capsule is left intact. Leaving the posterior capsule intact after pediatric cataract surgery leads to an unacceptably high rate of Posterior Capsular Opacification (PCO)[13]. The anterior vitreous serves as a scaffold for the migration of lens epithelial cells, resulting in PCO or visual axis opacification. Therefore, primary posterior capsulotomy and anterior vitrectomy are recommended for all children under 8 years old [14]. There are different methods of posterior capsulotomy and anterior vitrectomy: Anterior limbal or posterior pars plana approach. Anterior approach is most preferred approach, easy and has less complication. Anterior (limbal approach) includes manual posterior capsulorhexis and Vitrectorhexis. We conducted this study to assess these complications in peadiatric population, as understanding them is crucial for refining surgical techniques, improving patient outcomes, and minimizing the risk of long-term vision issues in children.

To determine intraoperative complications encountered during posterior (forceps) capsulorhexis in pediatric cataract surgery through anterior approach.

METHODS

This prospective cohort study was conducted in the Pediatric Ophthalmology Unit at Institute of Ophthalmology of Liaquat University of Medical and Health Sciences, Jamshoro, from 1st July 2022 to 31st December 2022. The study included 50 pediatric patients, up to 12 years old, with congenital cataracts. Only the first operated eye of each patient was considered. Pediatric cataract extraction with posterior capsulorhexis was performed, with Intraocular Lenses (IOLs) implanted in all patients. For patients under 3 years who received IOL implantation, the IOL power was calculated using biometric measurements adjusted for anticipated eye growth. Sample size was calculated via WHO Open EPI software by taking prevalence of congenital cataract in one eye as 3.3%, with confidence interval of 95% and 5% margin of error [7]. Patients with microcornea, corneal dystrophies, microphthalmos, traumatic cataract, subluxated or dislocated lens, congenital glaucoma, uveitis, previous ocular surgery, persistent fetal vasculature and retinal detachment, were excluded from this study. Approval from Research Ethics Committee of Institute of Ophthalmology, Liaquat University of me Medical and Health Sciences, was taken prior to stating research. (No. LUMHS/R.E.C./I.O.L:-33). After taking informed consent, patients were enrolled for research. Detailed history was taken from parents. Complete ocular, systemic examination and workup was done. Posterior capsular management after cataract removal was done by capsular forceps through anterior approach. Intraoperative complications for each patient were recorded in the study proforma. All surgeries performed by single surgeon and detailed surgical notes were included in discharge card. Data were analyzed using SPSS 26.0. Quantitative variables were described in mean with SD. Qualitative variables were expressed in frequencies and percentages.

RESULTS

The study had 52% population as male while 48% were female, with 58% were right eyes 42% were left eyes. 24 patients (48%) were of up to 3 years of age, 9 patients (18%) were between 3 to 6 years, and 17 patients (34%) were over 6 years old. 29 eyes (58%) were right eyes and 21 eyes (42%) were left eyes (Table 1).

Table 1: Descriptive Statistics

Variables	Frequency (%)
Gender Distribution	
Male	26 (52%)
Female	24 (48%)
Age Distribution	
Up to 3 Years	24 (48%)
3 to 6 Years	09 (18%)
More than 6 Years	17 (34%)
Laterality of Eye	
Right	29 (58%)
Left	21 (42%)

Anterior chamber was collapsed in 14 eyes (28%) after initial paracentesis incision while 36 eyes (72%) maintained original position. Forward bulge of posterior capsule was present in 36% of eyes while in 64% forward bulge was absent. Vitreous thrust was found in 38% cases while in 62% there was no vitreous thrust. Clearance of anterior vitreous face was done in 42 eyes (84%), in 08 eyes (16%) some of vitreous could not be cleared due to non-visibility of vitreous gel. Centration of intraocular lens in relation to the centre of pupil was done in 46 eyes (92%), in 04 eyes (08%) intraocular lens could not be centered. 60% of anterior capsulorhexis cases were completed conveniently, while 40% encountered difficulties. Posterior capsulorhexis, on the other hand, demonstrated a higher rate of convenience, with 74% of cases completed without major issues, whereas 26% were deemed inconvenient due to procedural complexities.

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Table 2: Intraoperative Complications of Capsulorhexis in Pediatric Cataract Surgery

Variables	N (%)
Collapsed Anterior Chamber after Paracentesis	14 (28%)
Forward Bulge of Posterior Capsule	18 (36%)
Vitreous Thrust in to Anterior Chamber	19 (38%)
Anterior Vitreous Face Clearance	42 (84%)
Centration of Intraocular Lens	6 (92%)
Collapsing of Capsular Bag	17 (34%)
Convenience of Approach through Anterior Capsulorhexis	30 (60%)
Convenience of Posterior Capsulorhexis	37 (74%)

DISCUSSION

The management of pediatric cataracts presents unique challenges distinct from adult cases. Successful surgery in children necessitates a skilled pediatric surgeon, competent anesthetist, and experienced nursing staff collaborating as a cohesive team. Utilizing state-of-the-art instruments and advanced techniques is crucial for achieving optimal visual outcomes in pediatric eye surgery, as elaborated by Self JE *et al.*, [15]. The demographic distribution in our study showed a slight male predominance (52%) compared to females (48%), consistent with some previous studies of McClatchey SK *et al.*, and Park Y *et al.*, in pediatric cataract surgery demographics [16, 17]. Age distribution highlighted a significant proportion of patients under 3 years (48%) similar to the findings reported by Lagreze WA *et al.*, emphasizing the early onset of pediatric cataracts and the need for specialized surgical techniques and careful post-operative management in this age group [18]. Regarding intraoperative findings, our study identified specific challenges likes collapsing of anterior chamber after paracentesis, collapsing of capsular bag and vitreous thrust in to anterior chamber, which are commonly encountered in pediatric cataract surgery as reported by the study of Kim TY *et al.* The collapse of the anterior chamber after initial paracentesis incision was observed in 28% of cases, suggesting variability in intraocular pressure dynamics during surgery. The presence of a forward bulge of the posterior capsule in 36% of eyes underscores the technical difficulty in achieving optimal capsular management in these young patients, which was also reported by Mandal S *et al.*, in their study [19]. Vitreous thrust was noted in 38% of cases in comparison to the 71.42% of the cases, reported in the study of Katpar NA *et al.*, highlighting the safety of this approach [20]. Centration of the intraocular lens relative to the center of the pupil was achieved in 92% of eyes, indicating successful surgical technique in the majority of cases. However, challenges in centration were noted in 8% of cases as opposed to the anterior capsulotomy technique which has high proportion of the cases with difficulties in centration of lens, as was also reported by Sharma B *et al.*, [21]. Clearance of the anterior vitreous face was achieved in 84% of eyes, with difficulties in visibility leading to incomplete clearance in 16% of cases. This highlights the importance of intraoperative visualization techniques and surgeon experience in managing vitreous clearance effectively [22]. Visually significant posterior capsular opacification causes deprivation amblyopia, so our goal in pediatric cataract surgery to clear visual axis by removing lens opacity, creating a posterior capsular opening (rhexis) and anterior vitrectomy to prevent Visual Axis Opacification (VAO) and decrease the risk of deprivation amblyopia. Hosal BM and Biglan AW elaborated that primary posterior capsulorhexis and limited anterior vitrectomy is necessary to decrease the need of second surgery or YAG laser capsulotomy, as YAG laser capsulotomy in pediatric population is difficult to remove thickened capsule / membrane, intra ocular lens pitting is common, release of pigments further hamper the vision, so the primary posterior capsulorhexis and anterior vitrectomy is very important and mandatory step in pediatric cataract surgery to clear visual axis [23]. Recent literature highlights the intraoperative challenges and complications associated with performing posterior capsulorhexis using forceps in pediatric cataract surgery through an anterior approach. Compared to the use of a vitrectomy cutter, forceps capsulorhexis presents significant difficulties, particularly during anterior vitrectomy. However, it offers notable advantages over methods such as vitrectomy cutter or electrocautery. The stronger margins of the capsule achieved with forceps are better able to withstand pressure during intraocular lens implantation and help contain vitreous prolapse, thereby preventing the extension of the capsulorhexis. It is worth noting that the younger the child undergoing cataract surgery, the more challenging the procedure becomes, increasing the risk of a "run-away capsulorhexis" [24, 25]. The single-center design of our study and a small sample size of 50 pediatric patients, potentially has restricted the applicability of findings to larger, more diverse populations. Exclusion criteria for specific eye conditions have also further narrowed the representation of pediatric cataract cases typically seen in clinical settings, which are counted as major limitations of the study.

CONCLUSIONS

We found that performing posterior capsulorhexis in pediatric cataract surgery through anterior approach is a safe procedure and encountered posterior capsular bulging and vitreous thrust as the most common complications.

Authors Contribution

Conceptualization: AJ
Methodology: NAS, MLM, AJ
Formal analysis: NAS, MLM, AJ

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Writing, review and editing: NAS, MLM, AJ

All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

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