APHAKIC AND PSUDOPHAKIC GLAUCOMA POST-CONGENITAL CATARACT SURGERY

Mohannd Aljetaily[1*], Nawaf Alanazi[2], Faleh Alqahtani[3]

Abstract:

Background: Glaucoma is the most frequently reported complication post congenital cataract surgery. Lens status (aphakia or pseudophakia) appears to have a direct role in the development of glaucoma post-surgery although the mechanism is not well understood.

Aim: To determine the incidence of aphakic and pseudophakic glaucoma in our population, common complication post-cataract extraction surgery. the effect of early implantation of intraocular lens on development of glaucoma, reviewing the medical and surgical options on managing glaucoma patients and their visual outcomes.

Methods: This is an analysis of patient records who underwent congenital cataract surgery in a single center in Saudi Arabia between the years 2008 and 2018. All patients gave informed consent and data collection was done in a manner consistent with patient privacy standards and approved by the center's ethics board. Data were tabulated in MS excel and all statistical data were analyzed in SPSS version 21.

Results: A total of 199 patients were included in the study. Glaucoma incidence in this sample was 20.2% overall 11.1% were aphakic and 10.1% were pseudophakic. Glaucoma in the psudophakic group developed at a later time compared to the aphakic group (66.9 ± 24.3 months vs 24.6 ± 33.1 months; P<0.001). The mean age when IOL inserted in glaucoma patients was significantly longer when compared to normal pseudophakic patients (T=-1.805; p=0.004). More than a half of patients (51.4%) used only one medication with 40.5% of them reported to have additional surgery. The most commonly cited type of surgery was trabeculectomy (41.2%), followed by tube surgery (35.3%).

Conclusion: glaucoma post congenital cataract surgery is difficult entity. The incidence of aphakic glaucoma group was higher in comparison to psudophakic glaucoma group. The delay in IOL implantation was a risk factor for developing glaucoma. Trabeculectomy was the surgery of choice when manging glaucoma in these patients. The prognosis is guarded life-long follow up is mandatory.

Keywords: Aphakic, pseudophakic, glaucoma, cataract surgery, retrospective

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Introduction:

Congenital cataract is a relatively common conditi on with a prevalence reported to be from 1 to 15 p er 10,000.(1).In population-based analysis the prevalence of cataract among children in SaudiArabia was 14.7 per 10,000. (2). This is in fact the world's highest estimate.

Glaucoma is quite wellknown complication in ped iatric cataract surgery. Possible underlying causes include chronic postoperative inflammation trabeculitis. The process leading to cataract formation may also reduce the aqueous outflow from trabecular meshwork, resulting in chronic open-angle glaucoma (3).The reported pseudophakia incidence of glaucoma was lower than aphakic group. (4-6). This triggered hypotheses that IOL might protects against the development of glaucoma. Various studies have reported a rise in glaucoma incidence over a long follow-up period (7). Established evidence showing long-term visual effects on patients with glaucoma.

Glaucoma treatment post-cataract surgery is complicated, with both surgical and medical options needed. There are several surgical procedures available. In a recent report by the American Academy of Ophthalmology, Chen et al. Reviewed current developments in paediatric glaucoma. Surgical procedures for childhood glaucoma generally fall into the categories of angle surgery (ab interno [goniotomy] or ab-externo [trabeculotomy]), filtering surgery, combinations of these two, aqueous drainage devices, and cyclodestructive procedures.

Filtering surgery is generally less successful in childhood comparing to adult glaucoma due to more intense scarring in the paediatric age group, a problem commonly tackled with the addition of antimetabolites to the filtering surgery(8). Combining angle and filtering surgeries reportedly provides the highest success rates, above the 90% limit. Aqueous drainage device surgery and cyclodestruction are generally reserved for refractory cases and generally have poorer outcomes and short-term success(9).

The purpose of this study was to know the incidence of aphakic and pseudophakic glaucoma in our population, common complication post-cataract extraction surgery, the effect of early implantation of intraocular lens on development of glaucoma and reviewing the medical and surgical options on managing glaucoma patients with their visual outcomes.

Methods:

This is an analysis of patient records carried out among all Saudi patients who underwent cataract surgery between 2008 and 2018 at Dahran Eye Specialist Hospital. Any patient with congenital cataract surgery from 2008 to 2018 were included in the study. Following a complete eye examination, intraocular pressure was determined in accordance with the method described by Simsek et al [12]. Patients with congenital glaucoma, traumatic cataract, persistent fetal vasculature and microphthalmos were excluded from the study. Confidentiality was assured to all participants who agreed to participate in the study. The respondents were given a brief description of the study and its objectives.

Data are presented using numbers, percentages, median (min-max), mean and standard deviation whenever appropriate. Between the comparison of variables, Chi square test, Mann Whitney U test and Kruskal Wallis were used, as appropriate. P-value <0.05 has is accepted as the significant level for all statistical tests. Statistical collinearity was performed using Shapiro Wilk test. All statistical data were analyzed using Statistical Packages for Software Sciences (SPSS) version 21 Armonk, New York, IBM Corporation.

Results:

A total of 199 patients who underwent cataract surgery were included in this study. As seen in table 1, the mean age at diagnosis was 12.7 months (SD 25.7) with more than a half were males (56.8%). With regards to the involved eye, slightly more (51.8%) were OS (left eye) and the rest (48.2%) were OD (right eye).

Table 2 shows the descriptive statistics of Aphakic and pseudophakic of the sample and the time of diagnosis in months. Up to 60% of them are pseudophakic while the normal aphakic was accounts for 19.6% and the rest were either aphakic glaucoma (11.1%) or pseudophakic glaucoma (10.1%) seen in Figure 1. The mean time when patients diagnosed with glaucoma was 44.7 ± 35.9 months (range: 0.03 – 126 months).

The proportion of patients who developed glaucoma among aphakic patients was 36.1% while the proportion of patients who developed glaucoma among pseudophakic patients was 14.4% as seen in figure 2.

Clinical characteristics of glaucoma patients were compared in table 3. Based on the results, the diagnosis of pseudophakic glaucoma was significantly longer compared to aphakic glaucoma (66.9 ± 24.3 months vs 24.6 ± 33.1 months; P<0.001). It is also demonstrated that the mean follow up of pseudophakic glaucoma was significantly longer when compared to aphakic glaucoma (99.6 ± 16.9 months vs 76.1 ± 35.5 months; P=0.012).

Moreover, it was observed that the mean age when IOL inserted in glaucoma patients was significantly longer when compared to normal pseudophakic patients (T=-1.805; p=0.004) (Table 4). Figure 3 shows the complications documented over 10 years. The most commonly known complication was pupillary membrane (21.8%) followed by shallow AC (16.4%) and endophalmitis (14.5%) while hyphema was the least common (1.8%). In table 5 the surgical outcome and medication used of 42 glaucoma patients measured over 10 years is detailed. More than a half of patients (51.4%) used only one medication with 40.5% of them reported to have additional surgery. The most commonly cited type of surgery was trabeculectomy (41.2%), followed by tube surgery (35.3%). Additionally, in the course of follow up, two third (33.3%) of the glaucoma patients exemplified moderate BCVA (range: 20/70 to 20/160), 25.6% reported to have normal vision (20/20) and 20.5% reported to have mild loss vision (range: 20/30 to 20/60).

Discussion

Glaucoma is considered as the major contributor for vision loss in post-lensectomy surgery. Since glaucoma may not develop for years after lensectomy, life-long follow-up is necessary.

Our data excludes obvious structural ocular abnormality other than pediatric cataract to assess features of aphakic and psudophakic glaucoma without the confounding effect of obvious microphthalmos, congenital glaucoma or persistent fetal vasculature. We confirm younger age at cataract diagnosis and the need for glaucoma intervention. Our study is limited by its retrospective design. Inconsistent documentation precluded our ability to assess for potentially important risk factors that may have influenced the risk for aphakic glaucoma, e.g., mild corneal diameter differences, poorly dilating pupils, cataract morphology, gonioscopic findings, and corneal thickness. In addition, because a glaucoma assessment was not universally documented before cataract surgery, it is possible that in some patients glaucoma predated cataract surgery.

This study examined the incidence of aphakic and pseudophakic glaucoma post congenital cataract surgery and its possible complication. The overall incidence of glaucoma in this study was 20.2%, compromising 11.1% of aphakic and 10.1% 0f pseudophakic glaucoma. The incidence of aphakic and pseudophakic glaucoma was higher in the findings of Simsek and colleagues. [12] The study evaluated the glaucoma and increased central corneal thickness in aphakic and pseudophakic patients after congenital cataract surgery. Authors found that the proportion of patients with aphakic and pseudophakic glaucoma was 30% and 20%, respectively while the overall incidence of glaucoma was 28%. Multiple studies demonstrated that the overall incidence of glaucoma in our study concurres with previous reports ranging between 2% and 28% [12-18]. Simsek and colleagues reported the highest incidence of glaucoma (28%) while Tatham and colleagues reported the lowest incidence rate (2%). This current study is consistent with the report of Comer and colleagues with 24%. Similarly, our study found that in the aphakic group, there were 36.1% who developed glaucoma while in pseudophakic group 14.4% developed glaucoma postoperatively. This result may, however, was consistent with the findings of Kirwan and colleagues [5] where they observed 33% of aphakic group had developed glaucoma whereas 10% developed glaucoma in pseudophakic group. Moreover, the study revealed that, in most cases aphakic glaucoma developed years after lensectomy. However, this is not consistenet with the findings of our study as the mean time of the onset in pseudophakic glaucoma was significantly longer than that of aphakic glaucoma (66.9 ± 24.3 months vs 24.6 ± 33.1 months; P<0.001) This result however, was contrary to the study of Kirwan and colleagues [5]. According to their results, the mean postoperative duration to diagnose glaucoma was significantly longer in aphakic group (65 ± 70 months) than in pseudophakic group (9 ± 9 months). Similarly, the longer time of follow-up had directly influenced the pseudophakic glaucoma (99.6 ± 16.9 months) more than that of aphakic glaucoma (76.1± 35.5 months). This is in contrast from the study of Kirwan et al. [5], where they documented that the duration of follow up was significantly longer in aphakic group (113 ± 69 months) compared to the pseudophakic group (56 ± 44 months).

It is suggested that IOL implantation following cataract surgery is a protective factor in glaucoma. In a study of Kirwan and colleagues. [5] they concluded that the primary implantation of an IOL following cataract surgery in children was not a protective factor against the development of glaucoma while Bazaz et al [13], indicated that age can be an influential factor for IOL implantation. In our study, the mean age of patients at the time of IOL implantation was significantly higher in glaucoma (27.2 ± 17.1 months) than those in normal pseudophakic group (18.5 ± 19.8 months) which suggested that delay in IOL implantation post-cataract surgery was a risk factor for glaucoma.

Post surgical complications has direct effect in the overall outcome of the patients. In this study, the most frequently reported complication post

surgical intervention was pupillary membrane (21.8%), shallow AC comes second (16.4%) and endophalmitis comes last (14.5%) as the most frequent. This is consistent with the reports of Chen and colleagues[2] as well as Corner and colleagues [18] where they documented pupillary membrane as the most common complication of patients after cataract surgery. On the other hand, Bayoumi reported inconsistent results regarding glaucoma complications postoperatively including endophthalmitis, hypotony, disc edema and retinal detachment.

Apart from cataract surgery, there had been cases where the glaucoma patients had undergone additional surgery to control IOP. In our study, 40.5% of glaucoma patients had underwent additional surgery. The prevalence of glaucoma patients who underwent different surgical procedures was recorded higher in Turkey [17] as well as in USA [18], with 70% and 83.3%, respectively while in another study conducted in USA [20], only 27% of glaucoma patients had sought another surgical intervention which was lower than our report. Furthermore, our study demonstrated that trabeculectomy was the most commonly sought type of surgical intervention (41.2%) followed by tube surgery (35.3%). Consistently, several papers reported that trabeculectomy was the most commonly required surgical intervention for the treatment of glaucoma [2,13,17,19].

Finally, the efficacy of surgical intervention among glaucoma patients can be measured directly through visual acuity. In this study, one third of the patients reported to have moderate visual acuity after 10 years of follow up, followed by normal vision (25.6%) and mild vision loss or near normal vision with 20.5%. This result is consistent with reports published in the USA [18, 20], where final visual acuity of patients was 20/40 or better in more than or equal to half of the patients (54% and 50%, respectively).

Conclusion

Although aphakic glaucoma developed more than pseudophakic glaucoma, the overall follow up and onset of pseudophakic glaucoma was significantly longer than that of aphakic glaucoma. Both aphakic and pseudophakic glaucoma are complicated eye conditions that could need more than one surgical intervention. Pseudophakic glaucoma potentially needs more monitoring. Delaying IOL implantation post lensectomy implies patients on higher risk for developing glaucoma. Long term follow-up is necessary to detect any lapses in the treatment to receive proper intervention.

Tables and Figures

Table 1: Preoperative characteristics of patients who underwent cataract surgery (n=199)

Preoperative data	N (%)
Age at diagnosis in months (mean ± SD)	12.7 ± 25.7
Gender	
• Male	113 (56.8%)
• Female	86 (43.2%)
Involved eye	
• Oculus dextrus	96 (48.2%)
• Oculus sinister	103 (51.8%)

Table 2: Descriptive statistics of Aphakic, Pseudophakic glaucoma and the time of diagnosis (n=199)

Parameters	N (%)
Glaucoma	
• Normal aphakic	39 (19.6%)
• Normal pseudophakic	118 (59.3%)
• Aphakic glaucoma	22 (11.1%)
• Pseudophakic glaucoma	20 (10.1%)
Time when diagnosed with glaucoma in months	
• Mean ± SD	44.7 ± 35.9
• Median (min – max)	48 (0.03 – 126)

Table 3: Clinical Characteristics of patients with aphakic and pseudophakic glaocoma after surgery

Factor	Aphakic N (%) (n=22)	Pseudophakic N (%) (n=20)	P-value
Age at diagnosis in months (mean ± SD) [a]	4.84 ± 6.56	6.77 ± 10.6	0.477
Time when diagnosed with glaucoma (mean ± SD) [a]	24.6 ± 33.1	66.9 ± 24.3	**<0.001 ****
Intraocular pressure in mmHg (mean ± SD) [a]	15.7 ± 5.65	14.2 ± 1.91	0.257
Follow up in months (mean ± SD) [a]	76.1 ± 35.5	99.6 ± 16.9	**0.012 ****
Gender [b]			
• Male	17 (77.3%)	10 (50.0%)	0.065
• Female	05 (22.7%)	10 (50.0%)	
Involved eye [b]			
• Oculus dextrus	11 (50.0%)	10 (50.0%)	1.000
• Oculus sinister	11 (50.0%)	10 (50.0%)	

[a] P-value has been calculated using Mann Whitney U test.
[b] P-value has been calculated using Chi Square test.
** Significant at p<0.05 level.

Table 4: Mean age comparison of implanted IOL in normal pseudophakic and glaucoma patients

Factor	Normal	Glaucoma	T-test	P-value [§]
Age in months when IOL inserted	18.5 ± 19.8	27.2 ± 17.1	-1.805	**0.004 ****

[§] P-value has been calculated using Mann Whitney U test.
** Significant at p<0.05.

Table 5: Surgical outcome and medication among patients with alphakic and pseudophakic glaucoma measured in 10 years (n=42)

Outcome parameters	N (%)
Number of medication (n=37)	
• One	19 (51.4%)
• Two	12 (32.4%)
• Three	05 (13.5%)
• Four	01 (02.7%)
Additional Surgery	
• Yes	17 (40.5%)
• No	25 (59.5%)
Type of Surgery (n=17)	
• Trabeculectomy	07 (41.2%)
• Tube	06 (35.3%)
• CPC	01 (05.9%)
• Other	03 (17.6%)
BCVA (n=39)	
• Normal	10 (25.6%)
• Mild	08 (20.5%)
• Moderate	13 (33.3%)
• Severe	06 (15.4%)
• Total blindness	02 (05.1%)

Figure 1: Incidence of Aphakic and Pseudophakic glaucoma after cataract surgery

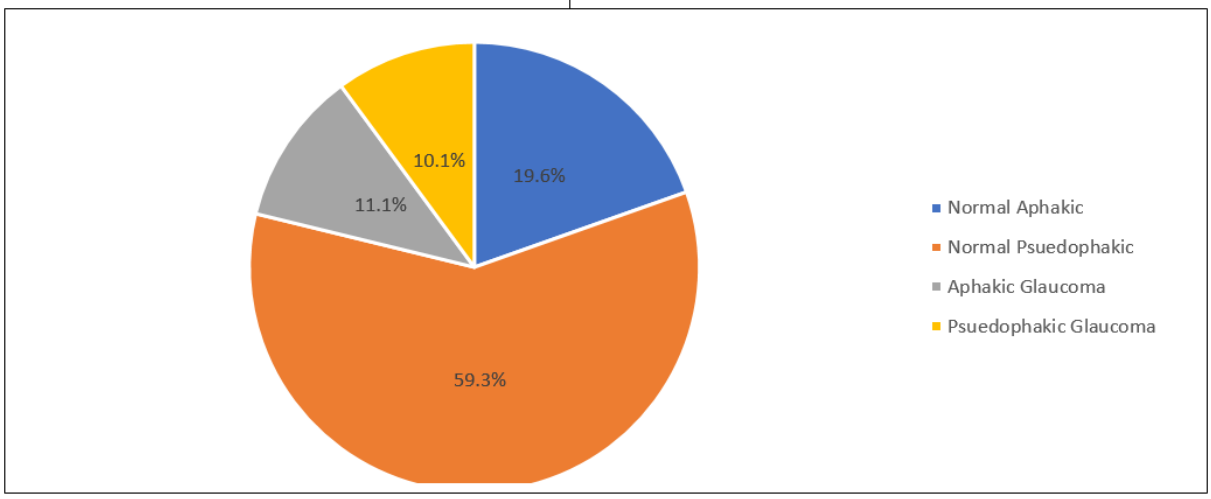


Figure 2: Incidence of Aphakic and Pseudophakic glaucoma between the two groups (aphakic and pseudophakic patients)

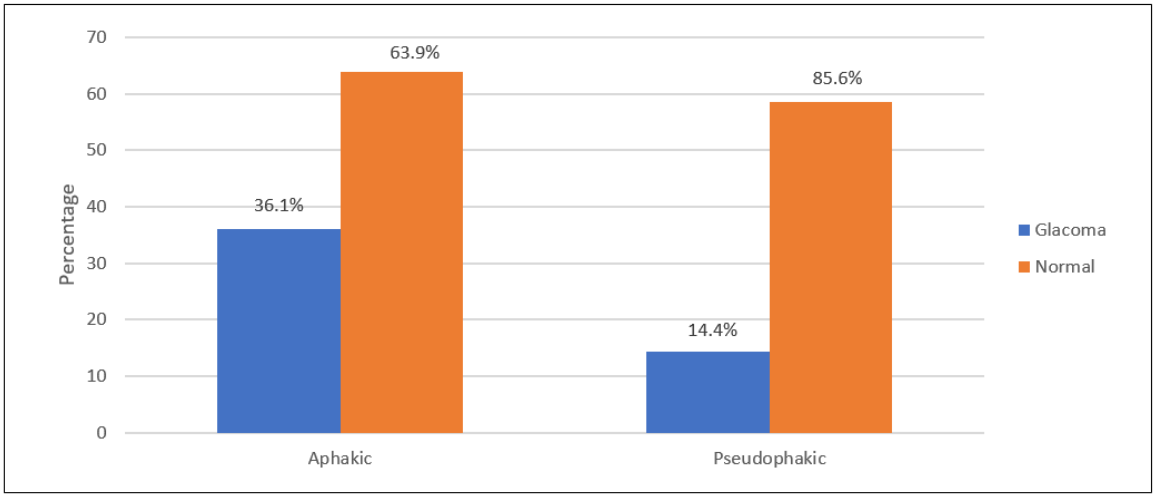
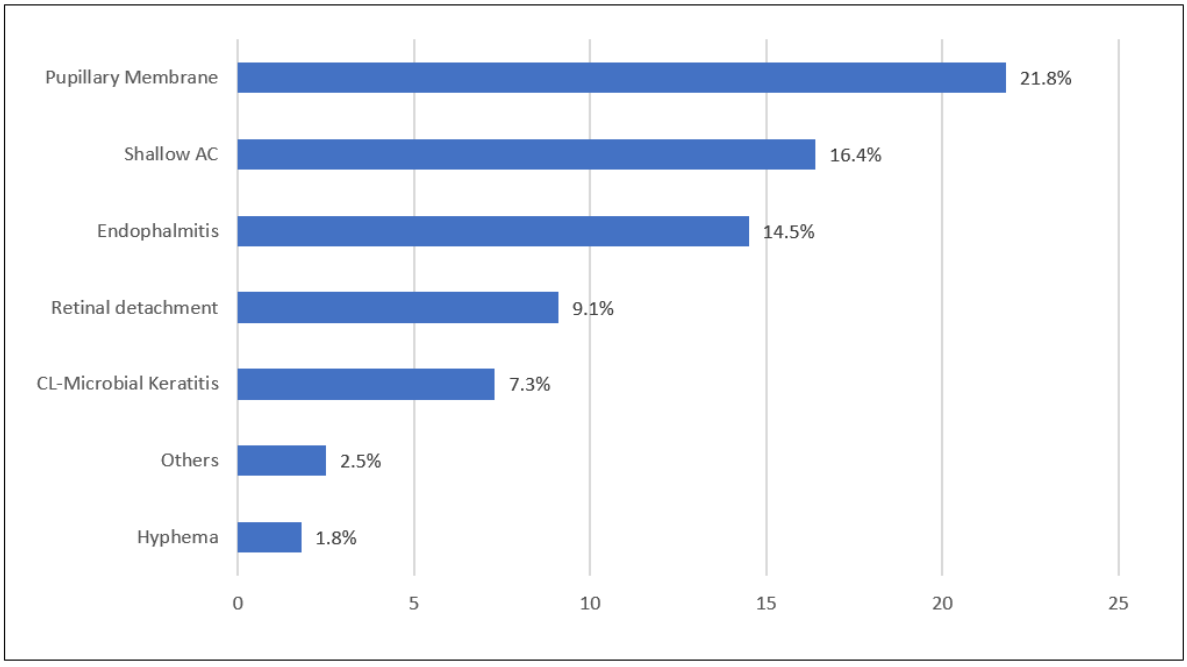


Figure 3: Complication of patients measured in 10 years



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