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Original Research Article

A clinical study on causes of small pupil and its management in Small incision cataract surgery

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ABSTRACT

Aim: To evaluate the causes of small pupil and its intra-operative complications in SICS.
Materials and Methods: A total of 50 patients presenting to OPD with Small pupil measured after maximal dilation using tropicamide (0.5%) with phenylephrine (1%) e/d administered 4 times at 15 minutes interval were enrolled in this study. Detailed clinical history, prior medication, presence of possible risk factors, underlying co-morbidities and history of trauma were noted for every case.
Results: The results drawn from the study out of 50 patients, revealed that 14 cases were associated with Pseudo-exfoliation syndrome, 16 cases with posterior synechiae (11 were associated with chronic uveitis And 5 cases had history of Trauma), 12 cases were associated with DM, 2 patients had history of intraocular surgery, 1 patient was on Tab. Tamsulosin for treatment of BPH. The remaining 5 cases were atonic pupil in old age patients.
Conclusion: The current study discusses the causes of Small pupil and its intra-operative complications along with its management. It's crucial for every cataract surgeon to cope with small pupil manifesting preoperatively and intra-operatively.

1. Introduction

Cataract is currently the main cause of avoidable blindness in the developing world accounting for about three quarters of blindness.[1] Indians were the first to begin operations on cataract by mastering the technique of "Couching". "Sushruta" practiced this technique in 800 AD and is considered as the father of cataract surgery.[2]

One of the most important things in cataract surgery is pupil size. A well dilated pupil with a sharp red reflex enhances the ease of cataract surgery and decreases the likelihood of complications. Keeping in mind that, there are numerous factors leading to poor pupil dilation including, but not limited to the systemic diseases. Intake of some pharmacological agents, local co-morbidities (glaucoma, ocular trauma, previous ocular surgery, uveitis, etc.), these eyes are generally more prone to increased permeability of the blood aqueous barrier, leading to postoperative inflammation.[3–5]

Mydriatic agents dilate the pupil by stimulating the dilator (adrenergic agonists) or by blocking the sphincter (cholinergic blockers). Adrenergic agents increase dilator activity. In few circumstances poor dilation could be due to ineffective dilating drops, poor administration technique or due to expired medication.[6]

Intra-operative floppy iris syndrome (IFIS) is another cause of miosis. Characterized by a flaccid iris which undulates in response to intraocular fluid currents, with a tendency to prolapse towards the area of surgery and may result in damage to the iris by intraocular instruments.[7]

No single approach will address any of the causes involved in poorly dilating pupil, the underlying patho-

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physiology should be taken into consideration for surgical plan of cataract surgery.

2. Aim

The aim of the study is to determine.

1. Possible risk factors of small pupil.
2. And intra-operative complications associated with small pupil.

3. Materials and Methods

Number of subjects: 50

Selection of subjects: Both male and females belonging to different age groups.

3.1. Inclusion criteria

All those with Small pupil measured after maximal dilation using tropicamide (0.5%) with phenylephrine (1%) e/d administered 4 times at 15 minutes interval.

3.2. Exclusion criteria

Patients with severe retinal diseases, Glaucoma patients on pilocarpine medication, Systemic diseases that may affect pupil function such as multiple sclerosis, Parkinson's disease, Alzheimer's disease, Patients that may affect autonomic functions such as chronic lung diseases, cardiovascular pathologies.[8]

The nature of the study and the possible outcome were explained, and a written consent was obtained from each patient.

4. Observation and Results

Out of 50 cases in this study, majority of them belong to 61 to 80 years of age (Table 1). Pseudo-exfoliation syndrome (PXF) is the significant association.

Table 1: Age distribution

Age	Number of cases	Male	Female	Percentage
<40	0	0	0	0%
40 – 60	14	06	08	28%
61 – 80	34	14	20	68%
>81	02	2	0	04%
Total	50			

Out of 50 cases, 22 were male (44%), 28 were female (56%). Male to female ratio is 1:1.2(Table 2)

Causes of Small pupil observed in this study were as follows (Table 3). Majority were associated with PXF followed by presence of posterior synechiae and diabetes mellitus.

Table 2: Gender distribution

Gender distribution	Number of cases	Percentage
Male	22	44%
Female	28	56%

Table 3: Causes of small pupil

Causes of Small pupil	No of cases	Percentage
Pseudo-exfoliation Syndrome	14	28%
Posterior synechiae	16	32%
DM	12	24%
Atonic pupil	05	10%
Intra-ocular surgery	02	4%
Treatment history (Tab.tamsulosin)	01	2%
Total	50	

Table 4: Cataract grading

Type of cataract	No. of cases	Percentage
CC	12	24%
NS 1	02	4%
NS 2	14	28%
NS 3	17	34%
NS 4	04	8%
PSC	01	2%
Total	50	

On pre-operative evaluation, the grading of cataract was as mentioned below (Table 4)

The intra-operative complications were seen in as follows (Table 5).

Table 5: Intra-operative complications

Intra-operative complications	Number of cases	Percentage
Descemet's detachment	02	4%
Hyphema	01	2%
Anterior chamber collapse	08	16%
Difficulty in nucleus delivery	16	32%
Iridodialysis	01	2%
PC rent	06	12%

As a measure of strategic plan of cataract surgery, preoperatively ketorolac (0.3%) e/d was started one week prior to the surgery. Intra-operative management was followed was as mentioned below (Table 6)

Table 6: Intra-operative management

Intraoperative management	No. of. cases	Percentage
Mydricaine	12	24%
Intracameral epinephrine	08	16%
Viscomydriasis	08	16%
Synechiolysis	16	32%
Sphincterectomy	02	4%
Iris stretch hooks	04	8%

In our study post-operative complications were noted in 14 cases (Table 7)

Table 7: Post-operative complications

Post-operative complications	No. of. cases	Percentage
Uveits	4	8%
Hyphema	3	6%
Striate keratopathy	3	6%
Irregular and atonic pupil	4	8%

5. Discussion

All the 50 patients enrolled in this study underwent small incision cataract surgery. The findings were recorded.

1. Age distribution: Majority of the patients belong to age group of 61 to 80 years of age (68%). Followed by age group of 41 to 60 (28%). It's because of increased incidence of pseudo-exfoliation, uncontrolled diabetes in these cases.
2. Gender distribution: In our study female preponderance was seen. Male (44%) and Female (56%), Male to Female ratio was 1**:** 1.2 while Aravind et al. in 2003 showed no sex predilection. Avramides, Sakkias and Traindis reported a female preponderance.[9]
3. Causes of small pupil: Our study reveals that the common causes are PXF (28%), Posterior synechiae (32%), Diabetes(24%),atonic pupil (10%), Intraocular surgery- Trabeculectomy (4%) and patients on alpha adrenergic drugs i.e Tab tamsulosin (2%) for treatment of BPH.
4. Type of Cataract: Most of the patients undergoing surgery had Grade 2 to Grade 3 NS (62%) followed by Cortical cataract(24%).
5. Intra-operative complication: Complications were noted in 34 cases. Descemet's detachment (4%), Hyphema (2%), Anterior chamber collapse (16%), difficulty in nucleus delivery was seen in most of the cases (32%), Irido-dialysis (2%) and PC rent (12%) was seen.
6. Intra-operative management**:** Management was carried out in view of 'on table' challenging factors. Mydricaine (1.3mg atropine sulphate, 0.12mg of adrenaline and 8.4mg procaine hydrochloride in single vial of 0.4ml) was effective in 12(24%), Intracameral epinephrine in 8(16%) cases, Viscomydriasis in 8(16%) cases, synechiolysis in 16(32%) cases, sphincterectomy in 2(4%) cases and Iris stretch hooks in 4 cases (8%)
7. Post-operative complications: In our study 14 cases had post-operative complications. Uveitis in 4 cases (8%), Hyphema in 3 cases (6%), Striate keratopathy in 3 cases (6%) and irregular and atonic pupil in 4 cases (8%). Highest number of complications seen with PXF.

6. Conclusion

As mentioned above there are various factors for small pupil. A careful pre-operative evaluation of Status of cornea, AC depth, degree of dilation, pseudo-exfoliation, presence of posterior synechiae, cataract grading, zonular weakness, retinal evaluation and systemic evaluation helps the surgeon to plan efficiently.[10,11]

One of the important factors is pupil size. Adequate pupil dilation with red reflex is necessary for safe and successful cataract surgery. The surgical strategy can be planned after evaluating the pupil status whether it's rigid or elastic.[12] When anterior chamber is inlated with balanced salt solution after making a paracentesis or sideport , pupil enlarges if it's elastic likewiseIntra-operative floppy iris syndrome (IFIS). In case of rigid pupil, it does not bulge.[26]

In our study all the cases were started with preoperative ketorolac e/d(0.3%) 1 week prior to the surgery. This accounted for good results.[13] Additional precautions taken by avoiding cyclopentolate for dilation on previous day as it leads to pupillary fatigue on day of surgery.[14]

In our study intra-operative mydricaine, Intracameral epinephrine, Viscomydriasis, Synechiolysis, sphincterectomy and Iris stretch hooks produced adequate outcome for management of small pupil.

Apart from pupil expansion additional care to be taken to avoid complications such as excessive tissue handling eventually causing hyphema, tendency for iris prolapse can be avoided by extending tunnel into cornea, incomplete staining of pupil has impact on compromised capsulorrhexis, it further complicates with anterior capsular tear. Adequate hydrodissection and hydrodilineation reduces chances of PC rent. Iol placing difficulties should be overcome by placing directly in bag.

In our study we conclude that with all the above discussed methods, Increase in the margin of safety and decrease in the degree of complications was observed.

7. Conflict of Interest

The authors declare that there are no conflicts of interest in this paper.

8. Source of Funding

None.

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