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CORRELATION OF PUPILLARY SIZE AND REACTION WITH VISUAL OUTCOME IN LENS INDUCED GLAUCOMA

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ABSTRACT: PURPOSE: To correlate pupil size and pupillary reaction pre operatively with post-operative vision in lens induced glaucoma. **MATERIALS AND METHODS:** Settings and Design- Prospective study. Twenty five patients with lens induced glaucoma attending the outpatient and in-patient department, Department of Ophthalmology, K.R.Hospital, Mysore, were included under the study, between the period from January 2014 to July 2014 (6 months). Informed and written consent was taken from all the patients. A detailed history of each patient was obtained regarding the age, sex, ocular symptoms and its duration, past history and treatment history. Routine ocular and systemic examination was done. Pupil size measurement was done using pupillary gauge. Intraocular pressure recording done using rebound tonometry and Biometry was done. All patients then underwent lens extraction with PCIOL implantation. Post op day 1 and day 7 vision was recorded using Snellen's visual acuity chart. **STATISTICAL ANALYSIS:** All data were analyzed using descriptive statistics and Chi square test and contingency coefficient analysis was applied. **RESULTS:** Twenty five patients were examined. 17(68%) were Phacolytic type and 8 (32%) were Phacomorphic. It was found that 7 patients (28%) had pupil size of 3mm, 8 patients (32%) had 4mm, 6 patients (24%) had 5mm and 4 patients (16%) had 6mm. Post Op day 1 vision were all poor (less than counting fingers 3mts) irrespective of pupil size. Post Op Day 7 vision was better (more than counting fingers 3mts) in patients with pupil size 3mm ($P = 0.010$), was statistically significant and vision gradually decreased with increase in pupil size. Patients with good pupil reaction at presentation had good post op day 7 vision. **CONCLUSION:** Lens induced glaucoma patients with smaller pupil size and with better pupillary reaction pre-operatively had good postoperative visual outcome. **KEYWORDS:** phacolytic glaucoma, phacomorphic glaucoma, pupil size, pupil reaction, post op visual outcome.

INTRODUCTION: Group of glaucomas that share the lens as a common pathway in their pathogenesis is called lens induced glaucoma.¹ It can develop through either open-angle or angle-closure mechanisms. Phacolytic glaucoma and lens particle glaucoma are types with open angle. Phacomorphic glaucoma and glaucoma secondary to ectopia lentis are types with closed angle. Glaucoma associated with phacoanaphylactic uveitis can either be open or closed angle.

The World Health Organization estimates that nearly 18 million people are bilaterally blind from cataract in the world, representing almost half of all global cases of blindness. Cataract remains the leading cause of blindness and an important cause of visual impairment across the globe. With a cataract backlog of around 12 million² and annually increasing at an estimated rate of 3.8 million,³ it is not surprising that the occurrence of lens induced glaucoma (LIG) is not an infrequent event in India with an incidence around 3.9%.⁴

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It has long been recognized clinically that several forms of glaucoma may occur in association with the formation of cataracts, which are an important cause of secondary glaucoma in the developing world. These lens-induced glaucomas are a common occurrence in India, hardly surprising in a situation where the incidence of cataract cases far exceeds the total number of surgeries performed currently.⁵

Several studies have been done to correlate the duration and severity of glaucoma with visual outcome. It was observed that good pupillary reaction also indicated good visual outcome but no study has been undertaken so far. The present study has endeavored to correlate the pre-operative pupillary size and reaction with the post-operative vision, in patients presenting with lens induced glaucoma undergoing uncomplicated lens extraction

OBJECTIVE OF THE STUDY: To correlate pupil size and pupillary reaction pre operatively with post-operative vision in lens induced glaucoma.

MATERIALS AND METHODS: SOURCE OF DATA: All patients attending the outpatient and in-patient department, Department of Ophthalmology, K. R. Hospital, Mysore, diagnosed as lens induced glaucoma who fulfill the inclusion and exclusion criteria, between the period from January 2014 to July 2014 (6 months)

SETTINGS AND DESIGN: Prospective study.

SAMPLE SIZE: 25 patients.

INCLUSION CRITERIA: All patients with lens induced glaucoma.

EXCLUSION CRITERIA:

- Long standing lens induced glaucoma gone into absolute stage.
- Patients with corneal decompensation.
- Patients with primary open angle glaucoma, primary angle closure glaucoma.
- Patients with other types of secondary glaucomas.

METHOD OF STUDY: Data was collected using a piloted proforma meeting the objectives of the study after an informed and written consent taken from all the patients. A detailed history of each patient was obtained regarding the age, sex, ocular symptoms and its duration, past history and treatment history. Routine ocular and systemic examination was done. Pupil size measurement was done using pupillary gauge. Visual acuity testing was done using Snellen's visual acuity chart. Pupil size measurement was done using pupillary gauge.

The anterior chamber depth was assessed by directing the slit beam adjacent to the limbus. The AC was considered shallow if the depth was less than 1/4th of the corneal thickness (Van Herrick's grading). Phacomorphic glaucoma was recognized by the subjective complaints of pain, redness with the presence of corneal edema, shallow anterior chamber and an intumescent cataractous lens. Phacolytic glaucoma was diagnosed by the presence of pain, corneal edema, normal or deep anterior chamber, flare, cells, with minimal KPs, the presence of hypermature cataract with

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or without white spots on the anterior capsule. Intraocular pressure was measured using rebound tonometer. Biometry including Keratometry and A-scan was done.

Initially, control of IOP was done with intravenous mannitol 1gm/kg body weight, tab. acetazolamide 250 mg oral two times a day and topical timolol maleate 0.5% 12 hourly. Topical prednisolone acetate 1% eye drops 4 times a day was given to reduce inflammation. All the patients were subjected to manual small incision cataract surgery with PC IOL implantation.

All the operated cases were examined postoperatively on day 1 and day 7. The patients were followed up in OPD for a period of 6 weeks. All the patients were put on topical moxifloxacin and prednisolone six times a day during post-operative period. A short acting cycloplegic was also added. On the follow up, visual acuity, anterior segment examination, tonometry and fundus examination was done.

STATISTICAL ANALYSIS: All data were analyzed using descriptive statistics and Chi square test and contingency coefficient analysis was applied.

RESULTS: A total of 25 patients with lens induced glaucoma were analyzed. In our series 9(36%) patients were less than 60 years, 10(40%) patients were in the age group of 61-70 years and 6(24%) patients were more than 70 years of age. Maximum number of patients was in the sixth decade of life (Table 1).

Females (80%) were more in the current study (Table 2). Of the 25 patients, 17(68%) patients had phacolytic glaucoma and 8(32%) patients had phacomorphic glaucoma. (Table 3) The most common symptoms were ocular pain, defective vision and redness of eyes. Duration of pain of less than 5 days was seen in 2(8%) cases, 6-10 days in 16(64%) cases and more than 10 days in 7(28%) cases. Maximum duration of ocular pain reported was 15 days (Table 4).

The visual acuity at the time of admission was hand movements close to face in 1 patient (4%), perception of light with accurate projection of rays in 22 patients (88%), with inaccurate projection of rays in 1 patient and absent perception of light in 1 patient (Table 5). In the present study the highest IOP recorded was 66 mm Hg, the lowest was 26 mm Hg and most (44%) of the IOP ranged from 41mm Hg to 50 mmHg (Table 6).

POST OPERATIVE FINDINGS: It was also found that patients with duration of pain less than 5 days had vision better than 6/60 on post op day 7 (Table 7). Out of 16 Patients with duration of symptoms from 6 to 10days, 1 patient(6.25%) had post op day 7 vision better than 6/60, 7(43.75%) patients had vision between 6/60 and counting fingers 3mts and 8(50%) patients had vision poorer than counting fingers 3mts.

Out of 7 Patients with duration of symptoms from 11 to 15days, no patient had post op day 7 vision better than 6/60, 3(42.85%) patients had vision between 6/60 and counting fingers 3mts and 4(57.14%) patients had vision poorer than counting fingers 3mts. It was observed that lesser the IOP at presentation, better the vision on post op day 7 (Table 8). Out of 2 patients with IOP at presentation between 21-30mmHg, none had post op day 7 vision of 6/60 or better, 1 (50%) patient had vision between 6/60 and counting fingers 3mts and 1(50%) patient had vision poorer than counting fingers 3mts IOP at presentation between 41-50mmHg and 2 patients had IOP between 51-60mmHg 1 patient (6.25%) had post op day 7 vision better than 6/60, 7(43.75%) patients had.

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Out of 4 patients with IOP at presentation between 31-40mmHg, none had post op day 7 vision of 6/60 or better, 1 (25%) patient had vision between 6/60 and counting fingers 3mts and 1(75%) patient had vision poorer than counting fingers 3mts. Out of 11 patients with IOP at presentation between 41-50mmHg, 2 (18.18%) patients had post op day 7 vision of 6/60 or better, 2 (18.18%) patients had vision between 6/60 and counting fingers 3mts and 7(63.63%) patient had vision poorer than counting fingers 3mts.

Out of 7 patients with IOP at presentation between 51-60mmHg, 2 (28.57%) patients had post op day 7 vision of 6/60 or better, 3 (42.85%) patients had vision between 6/60 and counting fingers 3mts and 2(28.57%) patient had vision poorer than counting fingers 3mts. Only 1 patient had IOP at presentation more than 60mmHg and his post op day 7 vision was less than counting fingers 3mts.

It was found that 7 patients (28%) had pupil size of 3mm, 8 patients (32%) had 4mm, 6 patients (24%) had 5mm and 4 patients (16%) had 6mm. Post Op day 1 vision were all poor irrespective of pupil size at presentation. 2 patients who presented with pupil size 3mm had post op day 1 vision between 6/60 and counting fingers 3mts (Table 9). Out of the 23 patients with post op day 1 vision of less than counting fingers 3mts, 5(21.73%) patients had presented with 3mm pupil size, 8(34.78%) patients with 4mm, 6(26.08%) patients with 5mm, 4 (17.39%) patients with 6mm.

In this study, 5 patients had 6/60 or better post op day 7 vision and all 5 patients (100%) had pupil size 3mm (P – 0.010) 6 patients had vision between 6/60 and counting fingers 3m, out of which 1 (16.67%) patient had pupil size 3mm, 2 (33.33%) patients had 4mm, 2 (33.33%) patients had 5mm and 1 (16.67%) patient had 6mm. 14 patients had a poor vision of counting fingers 3mt or less, out of which 1 (7.14%) patient had pupil size 3mm, 6 (42.85%) patients had 4mm, 4 (28.57%) patients had 5 mm, 3(21.42%) patients had 6mm (Table 10).

Patients with good pupil reaction at presentation had good post op day 7 vision (Table 11). In this study, 5 patients had 6/60 or better post op day 7 vision and all 5 patients (100%) had sluggishly reactive pupil. 6 patients had vision between 6/60 and counting fingers 3mt, out of which 5 (83.33%) patients had sluggishly reactive pupil and 1 (16.67%) patient had fixed and not reactive pupil. 14 patients had a poor vision of counting fingers 3mt or less, out of which 9 (64.28%) patients had sluggishly reactive pupil and 5 (35.71%) patients had fixed and not reactive pupil.

DISCUSSION: Lens induced glaucoma was first described in year 1900 by Gifford and Von Reuss independent of each other. While former described it as a glaucoma associated with hypermature cataract, later described it as a glaucoma associated with spontaneous absorption of lens substance through intact lens capsule. Subsequently various workers described such types of cases under different names like lens induced glaucoma, lens induced uveitis and glaucoma, phacotoxic glaucoma, phacogenetic and phacogenic glaucoma and finally phacolytic glaucoma.

These terms including the more popular terms phacolytic glaucoma have been discarded by and for various reasons and convenience in favor of the term 'Lens induced glaucoma. At present, lens induced glaucoma connotes a clear cut clinical condition characterized by (i) a violent secondary glaucoma, (resembling acute angle closure glaucoma) in one eye with senile mature cataract, hypermature senile cataract (rarely immature senile cataract) yet with an open angle, (ii) normal intraocular pressure and open angle in other eye and (iii) a prompt relief of symptoms and restoration of vision after cataract extraction in the affected eye.

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This preventable and curable condition, though rare in developed countries for decades is unfortunately still prevalent in our country. Even though awareness of cataract & its surgical treatment is ever increasing in our society, lens induced glaucoma continues to occur more often in India. This study included 25 patients with lens induced glaucoma. In our study, maximum (40%) patients were in sixth decade.

Females (80%) were more than males. Phacolytic glaucoma (68%) was more than phacomorphic glaucoma (32%). Duration of symptoms was mostly (64%) between 6 and 10 days. The visual acuity at the time of admission was perception of light with accurate projection of rays in 88%. In the present study the highest IOP recorded was 66 mm Hg, the lowest was 26 mm Hg and most (44%) of the IOP ranged from 41mm Hg to 50 mmHg.

POST-OPERATIVE: It was found that patients with duration of pain less than 5 days had vision better than 6/60 on post op day 7. It was observed that lesser the IOP at presentation, better the vision (6/60 or better) on post op day 7. In our study we have also found that 7 patients (28%) had pupil size of 3mm, 8 patients (32%) had 4mm, 6 patients (24%) had 5mm and 4 patients (16%) had 6mm pre operatively. Post Op day 1 vision were all poor irrespective of pupil size at presentation. Post Op Day 7 vision was better (more than counting fingers 3mts) in patients with pupil size 3mm ($P = 0.010$), was statistically significant and vision gradually decreased with increase in pupil size.

Patients with good pupil reaction at presentation had good post op day 7 visions. All the results in our study are comparable to other studies except that number of patients with phacolytic glaucoma was more than phacomorphic glaucoma in our study. In a study by Pradhan D, Hennig A, Kumar J, Foster on 413 patients with lens induced glaucoma, found occurrence of LIG in the age range of 40 to 80 years and highest between 60 to 69 years (43.1%) age group. The female to male ratio was 1.7:1.

Phacomorphic glaucoma was present in 296 patients (72%) and phacolytic glaucoma in 115 (28%). Pain of more than 10 days' duration in the affected eye was the chief presentation in 293 of 413 (71%) patients. None of the 413 affected eyes had vision better than hand movement (HM) at presentation. At discharge, 120 of 311 operated eyes (38.6%) had 6/60 or better, 97 (31.2%) less than 6/60, and 94 (30.2%) had less than 3/60. IOP at presentation ranged from 14 to 81 mm Hg. 327 (79.2%) of 413 eyes had an IOP of more than 30 mm Hg at presentation.⁵

In a study by N Venkatesh Prajna, R Ramakrishnan, R Krishnadas, N Manoharan, a review on 93 patients with lens induced glaucoma was done. Phacomorphic glaucomas were present in 49 patients and phacolytic glaucomas in 44 patients. The mean age at presentation was 62 ± 10 years (range 43-85) for phacomorphic glaucomas and 63 ± 11 years (range 42-85) for phacolytic glaucomas. There was a slight female preponderance (54%) compared to the male population (46%).

The total mean preoperative intraocular pressure was 42 ± 12 mm Hg (range 22-70) while it was marginally higher for phacomorphic (45 ± 12 mmHg) than for phacolytic (40 ± 11 mmHg). The duration between onset of pain and surgery varied from 1 day to 45 days. 57% with phacomorphic and 61% with phacolytic glaucoma recovered visual acuity of 6/12 or better. They concluded that patients more than 60 years and in patients whom glaucoma was present for more than 5 days had a significantly higher risk of poor visual outcome.⁶

In a study by GL Dhar, Sudhir Bagotra, Anil Bhalla, 214 cases with L.I.G were analyzed. The majority of the patients were in the 6th decade of their life with the mean average age being 65.5

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years. Females were in preponderance (121 cases) compared to males (93 cases) and in a ratio roughly 4:3. 78.39% of patients sought admission in less than 7 days, 12.61% on 8th to 10th day, 5.6% between 11th and 14th days, and 3.27% between 15th and 22nd days.

Mean intraocular pressure in the affected eye was 36.6 mm Hg $\pm$ 7.4 mm Hg Schiotz. Corrected aphakic vision upto 6/18 and above was obtained in 169 (79.0%) cases, poor vision between 3/60 to 6/24 was recorded in only 36 (16.8%) cases, while 9 (4.2%) cases had poor vision not exceeding hand movements close to face.⁷

In a study by Payal Gupta, Sudhir Bhagotra, Suraj Prakash, 25 patients with a diagnosis of LIG were analyzed. Out of these 15(60%) patients had phacomorphic and 10(40%) had phacolytic glaucoma respectively. 6(24%) patients were less than 60 years, 14(56%) patients were in the age group of 61-70 years and 5 patients were more than 70 years of age. Maximum no. of patients were in the sixth decade of life. Females were more in this study. Duration of pain of 1 day was seen in 2(8%) cases, 2-5 days in 16(64%) cases, 6-10 days in 5(20%) cases and more than 10 days in 2(8%) cases. Maximum duration of ocular pain reported was 16 days.

The visual acuity at the time of admission was hand movement close to face or less. But none of the patient had faulty light projection. The highest IOP recorded was 59.1 mm Hg, the lowest was 33 mm Hg and the mean was 42.5 mm Hg. BCVA of 6/12 could be obtained in 6 (24%) patients. 16(64%) patients achieved BCVA upto 6/60. 3 (12%) patients showed visual recovery <6/60.⁸

CONCLUSION: Lens induced glaucoma patients with smaller pupil size and with better pupillary reaction pre-operatively will have good post-operative visual outcome.

	Frequency	Percent
41-50	2	8
51-60	7	28
61-70	10	40
71-80	3	12
81-90	3	12
Total	25	100

TABLE 1: AGE DISTRIBUTION

	Frequency	Percent
Males	5	20
Females	20	80
Total	25	100

TABLE 2: SEX DISTRIBUTION

	Frequency	Percent
Phacolytic	17	68
Phacomorphic	8	32
Total	25	100

TABLE 3: TYPE OF LENS INDUCED GLAUCOMA

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	Frequency	Percent
< 5	2	8
6-10	16	64
11-15	7	28
>15	0	0
Total	25	100

TABLE 4: Duration of symptoms (days)

	Frequency	Percent
PL negative	1	4
PL + PR inaccurate	1	4
PL + PR accurate	22	88
HM + PR accurate	1	4
Total	25	100

TABLE 5: Pre Op Vision

	Frequency	Percent
20-30	2	8
31-40	4	16
41-50	11	44
51-60	7	28
>60	1	4
Total	25	100

TABLE 6: IOP at presentation (mm Hg)

	6/36- 6/60	6/60 - CF 3mt	< CF 3mt	Total
< 5	2	0	0	2
6-10	1	7	8	16
11-15	0	3	4	7
>15	0	0	0	0
Total	3	10	12	25

TABLE 7: Duration of symptoms (days) with post op day 7 vision

	6/36- 6/60	6/60 - CF 3mt	< CF 3mt	Total
21-30	0	1	1	2
31-40	0	1	3	4
41-50	2	2	7	11
51-60	2	3	2	7
>60	0	0	1	1
Total	4	7	14	25

TABLE 8: IOP at presentation (mm Hg) with post op day 7 vision

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	3mm	4mm	5mm	6mm	Total
6/36 – 6/60	0	0	0	0	0
6/60 – CF 3mt	2	0	0	0	2
< CF 3mt	5	8	6	4	23
Total	7	8	6	4	25

TABLE 9: Post OP Day 1 vision with pupil size at presentation

	3mm	4mm	5mm	6mm	Total
6/36 – 6/60	5				5
6/60 – CF 3mt	1	2	2	1	6
< CF 3mt	1	6	4	3	14
Total	7	8	6	4	25

TABLE 10: Post OP Day 7 vision with pupil size at presentation

	Reactive	Sluggishly reactive	Fixed, not reactive	Total
6/36 – 6/60	0	5	0	5
6/60 – CF 3mt	0	5	1	6
< CF 3mt	0	9	5	14
Total	0	20	5	25

TABLE 11: Post OP Day 7 vision with pupil reaction at presentation

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