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A retrospective clinical study about the predictive factors for visual outcome of Lens Induced Glaucoma patients in a tertiary care center in Kerala.

Dr.Smitha M[1] ,Dr Devika K[2], Dr A,M Raja[3], Dr Dhanya V C[4].
1Assistant Professor Department of Ophthalmology, Government Medical College Palakkad, 2Assistant Professor Department of Ophthalmology Government Medical College Palakkad 3,Professor and HOD Department of Ophthalmology Government Medical College Palakkad,4 Lecturer Department of Ophthalmology, Government Medical College Palakkad

Abstract
Introduction*: To assess the clinical profile of Lens Induced Glaucoma (LIG) in Palakkad District of Kerala and final visual outcome of such patients was compared with preoperative rise of intraocular pressure (IOP) and their duration of presentation.*
Materials and Methods*: A retrospective study was conducted by analyzing medical records of 40 patients of senile cataract who were clinically diagnosed as LIGs and operated over a period of two years between January 2018to December2019 at Government Medical College Palakkad. The data was collected in terms of demographics, time of presentation of the patient, both preoperative and post operative visual acuity, IOP and intraoperative and postoperative complications. At 6 weeks post operative cataract surgery best corrected visual acuity (BCVA) was compared with duration of symptoms and preoperative IOP .*
Results*: Majority of LIG patients were sixth decade of life with female preponderance. Out of total 40 patients, majority improved in vision after cataract surgery with maximum number in range of 6/24 to 6/60 (37.5 %) and 13 eyes (35.5%) had vision 6/18 or better at 6 weeks follow up. The BCVA at 6 weeks was less than 6/60 in patients who presented late after one week ($\chi 2 = 12.3956$, P value =0.0146) and it was statistically significant. . Clinically, significant proportion of cases with IOP at presentation less than 30 mmHg (37.5%) achieved good visual acuity, than cases with IOP more than 40 mm Hg (20%), whereas 70 % cases with IOP more than 40 mm Hg had poor outcome of less than 6/60 visual acuity .The correlation between preoperative IOP and visual outcome was, clinically significant but statistically not significant .*
Conclusion*: The results shows that the earlier the patient of LIG reports, better is the final visual outcome and IOP control and therefore there is a strong need of education of rural elderly population about the early diagnosis and treatment of visually disabling cataract and dangers of lens-induced glaucoma.*
Keywords: *Lens induced glaucoma, Intraocular pressure, Best corrected visual acuity .*

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I. Introduction

Cataract is one of the most common causes of visual impairment in the world. According to the World Health Organization (WHO), cataract is the leading cause of blindness all over the world, responsible for 47.8% of blindness and accounting for 17.7 million blind people.[1, 2] In India, 62% of the blindness is due to cataract.[3, 4]

Lens Induced glaucoma is a common condition seen in patients with senile cataracts and is one of the commonest cause of secondary glaucoma, requiring an immediate attention and management to prevent blindness..These are heterogeneous group of disorders which develop through either open-angle or angle-closure mechanisms[5]. Phacolytic glaucoma and lens particle glaucoma are types of secondary open-angle glaucomas. The angle of anterior chamber is open with blockage of the trabecular meshwork by lens proteins. Phacomorphic glaucoma and lens displacement glaucoma are types of secondary angle-closure glaucomas. Phacoanaphylactic uveitis, now termed as lens-induced uveitis, is not truly an anaphylactic reaction but is a granulomatous reaction that can cause open-angle or angle-closure glaucoma or combined open-angle and angle-closure glaucoma [6].

Lens induced glaucoma though rare in developed countries, is unfortunately still prevalent in India. Lens-induced glaucoma (LIG) is common in developing countries owing to the delay in cataract removal. Lens-induced-glaucoma is a distinct pathological entity, clinically recognizable, easily preventable and often curable by cataract extraction[7]. Late reporting for treatment of cataract leading to serious complications like LIG remains one of the most important cause of irreversible loss of vision, especially so in the rural population.Pre-

operative and post-operative morbidity is more in an eye with lens induced glaucoma than that with a simple uncomplicated cataract. Prognosis and visual outcome are also affected to some extent. Hence timely intervention is important in achieving good results.

The purpose of this study is to determine the clinical presentations, management and outcome of lens induced glaucoma at Govt.Medical College Palakkad .

II. Materials And Methods

A retrospective study was conducted on the case records of 40 patients who were diagnosed with LIG in Govt.Medical College Palakkad between January 2018 and December 2019 after due permission granted by ethics research committee of the institute . All the LIG patients who had consented for cataract surgery were included in the study . Exclusion criteria were known cases of primary open angle or primary angle closure glaucoma, patients with other causes of secondary glaucomas, traumatic cataract, complicated cataract, pre-existing corneal scarring or opacity and any posterior segment pathology. Most of the patients enrolled in the study presented with symptoms of ocular pain, headache, blurred vision, nausea and vomiting .A detailed clinical examination included the status of the lens and the anterior chamber depth assessed by slit lamp biomicroscopy, applanation tonometry by Goldmann applanation tonometer . . The clinical examination of the patients revealed significant increase in IOP, reduced visual acuity, circumciliary congestion, corneal oedema. Fundus findings could not be recorded in all cases due to poor visibility. Keratometry and biometry of the affected eye and the fellow eye was done whenever possible.

Preoperative measures to decrease intraocular pressure included topical application of timolol maleate 0.5% twice daily supplemented with oral acetazolamide 250 mg four times a day along with inj mannitol100 ml was given if iop is above 30 mmHg . Topical steroids were also given preooeratively to reduce inflammation .Mannitol 200 ml of 20% was given intravenously just before surgery. The aim of treatment for these cases was to preserve useful vision, relief from pain, and reduction of the elevated ocular tension to almost normal levels, which was achieved by both medical and surgical methods. In all patients, cataract extraction with intraocular lens (IOL) implantation was advised under guarded prognosis.

Small incision cataract surgery with or without posteriorchamber IOL was performed after controlling intraocular pressure. A posterior chamber intraocular lens (IOL) was implanted wherever possible. The reasons for not implanting an IOL were presence of subluxated lens and posterior capsule rupture. A subconjuctival injection of dexamethasone (1 mg) and gentamycin (20 mg) was given at the end of the procedure.. Post operatively a combination of moxifloxacin prednisolone two hourly along with cycloplegics was given. They were then discharged with instructions to use a topical antibiotic steroid combination for a period of 6 weeks. Follow up of the subjects was performed on 1st postoperative day, 1st, , 4th and 6th postoperative week. Visual acuity examination and IOP evaluationwas done on1st ,4^{th} and 6^{th} postoperative weeks.. A good intraocular pressure control was defined as a final postoperative intraocular pressure of $\leq$ 21 mmHg, without the need for any antiglaucoma medication. A total ophthalmological evaluation including slit lamp biomicroscopy was performed. The posterior pole was evaluated using a 90D lens and the slitlamp. The results were tabulated on Microsoft excel spreadsheet and the data was statistically analyzed using various tests such as paired t-test, chi-square test, and pooled chi-square test wherever applicable and a p-value of < 0.05 was considered significant.

III. Results

Forty patients (40 eyes) with lens induced glaucoma were included in the study. Out of40 patients, 14(35%) were men and 26(65%) were women (Table 1) .The age of presentation was 42-83 years and majority between 60 -70 years (50%).

DEMOGRAPHIC DATA Table 1

AGE	MALE	FEMALE	TOTAL %
40 - 50	0	1 (2.5%)	1 (2.5%)
50 - 60	1 (2.5%)	3(7.5%)	4 (10%)
60 - 70	7(17.5%)	13(32.5%)	20 (50%)
70 - 80	4(10%)	8(20%)	12 (30%)
80 - 90	2(5%)	1(2.5%)	3 (7.5%)
Total	14 (35%)	26(65%)	40 100%

Symptoms of lens induced glaucoma Table 2

Symptoms of LIG	number
Reduced vision	40 100%
Eye pain	38 95%
redness	38 95%
nausea	23 57.5 %
Headache	31 77.5 %
Vomiting	10 25%

Almost all of them took treatment only after 6 months and 1 year of reduction in vision. Eye pain and redness were the main symptoms that brought the patients to the hospital. The main clinical symptoms were reduced vision (100%), eye pain (95%), eye redness (95%), headache (77.5%), nausea(57.5%) and vomiting (25%) (Table 2).

Visual acuity at presentation were Hand movement or less in 100% of patients. The visual acuity was markedly reduced in all cases due to cataract as well as due to loss of corneal transparency secondary to a sudden rise of intraocular pressure. The mean preoperative intraocular pressure was 44mmHg (range 28-64). After preoperative medication IOP reduction below 20 mm Hg was achieved in (75%) patients. At the time of discharge 95% recorded IOP below 22 mm Hg with or without using topical IOP lowering drugs. All patients underwent small incision cataract surgery (SICS) with and without intraocular lens (IOL) implantation. 36(92%) patients underwent uneventful SICS with posterior chamber IOL implantation. Four (2%) patients underwent SICS only because of complication of posterior capsular rupture,zonular dialysis and vitreous loss which was later managed by iris claw and scleral fixated sutured IOL . All patients were given preoperative topical steroid but three developed fibrin and 1patient developed hypopyon. While performing the surgery in five patients complete removal of the cortical material could not be achieved. Postoperative uveitis was seen in 13 (26%) patients and striate keratopathy in 14 (28%) cases.

The postoperative vision of patients was as shown in Table3. It can be seen that 32.5% of the patients recovered very good vision (6/18 or better) after surgery. Low vision/visual impairment(6/24–6/60)occurred in(37.5%)cases .12.5% had vision 6/60 -3/60. Unfortunately blindness(<3/60–PL) occurred in (17.5%) cases . Causes of poor BCVA were optic atrophy in 4 patients (10%), post-operative uveitis and cystoid macular odema in one patients (2.5%) , and corneal decompensation in two patients (5%) (Table 5).

Post operative visual Acuity Table 3

Post operative visual acuity	No	%
6/6-6/18	13	32.5%
6/24- 6/60	15	37.5 %
6/60-3/60	5	12.5 %
<3/60	7	17.5%

Intraoperative cataract surgery complications Table 4

Intraoperative complications	cases	%
Shallow anterior chamber	16	40%
PC rupture and vitreous loss	4	10 %
Cortical remnants	5	12.5 %
No implantation of IOL	3	7.5 %
Extension of capsulorhexis	10	25%

Post operative complications Table 5

Post operative complications	cases	percentage
Optic atrophy	4	10 %
Corneal decompensation	2	5%
Hyphema	3	7.5%
Cystoids macular odema	1	2.5%
Anterior uveitis	8	20 %
Striate keratitis	14	35%

Table 4 and Table 5 shows the complication profile of the patients during and after surgery. Shallow anterior chamber due to posterior vitreous pressure was seen in 16(40%) patients. PCR occurred in 4 eyes (10%) capsulorrhexis extended in 10 eyes (25%). Out of 40 eyes, 4 eyes (10%) were left aphakic as IOL could not be implanted which was later managed by iris claw lens and scleral fixated IOL. Postoperative complications were mostly treatable including uveitis in 8 eyes (20 %%) and striate keratitis in 14 eyes (35%), but 4 eyes (10%) had glaucomatous optic atrophy and two eyes (5%) landed up in corneal decompensation .. Anterior uveitis was

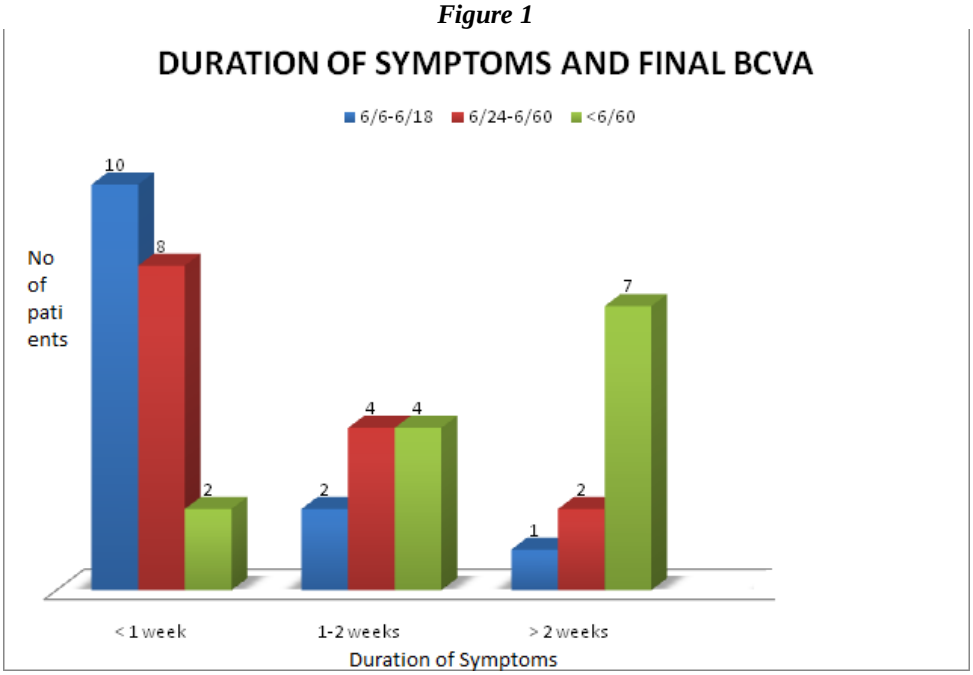
treated with topical steroids, cycloplegic and systemic steroids. Majority of the patients recovered within 1 week with the treatment and all the 8 cases did not show any AC reaction at the end of 2 weeks follow-up period

BCVA at 6 weeks was studied in relation with duration of presentation (table6),(Figure 1) .Out of 20 cases who presented within one week, 10 (50%) had good vision (6/6-6/18), 8 cases had useful vision(6/24-6/60) and remaining 2 cases had poor vision (10%) .10 cases who presented in 1-2 weeks 2 cases (20%) had good vision and 4 cases with poor vision . In 10 cases who presented > 2 weeks 1(10%) had good vision and 7(70%) patients had poor vision(<6/60) . Out of total 40 patients 20 presented within a week and 20 after one week and there was significant correlation between BCVA and time of presentation as BCVA was less than 6/60 in majority of patients who presented late after one week ($\chi 2$ =12.3956, P value =0.0146) .

Duration of symptoms and final BCVA Table 6

Duration of symptoms	Final BCVA		
	6/6-6/18	6/24-6/60	<6/60
< 1 week	10 (25%)	8 (40 %)	2 (5%)
1-2 weeks	2 (5 %)	4 (10 %)	4 (10 %)
>2 weeks	1(2.5 %)	2 (5 %)	7 (17.5)

Figure 1

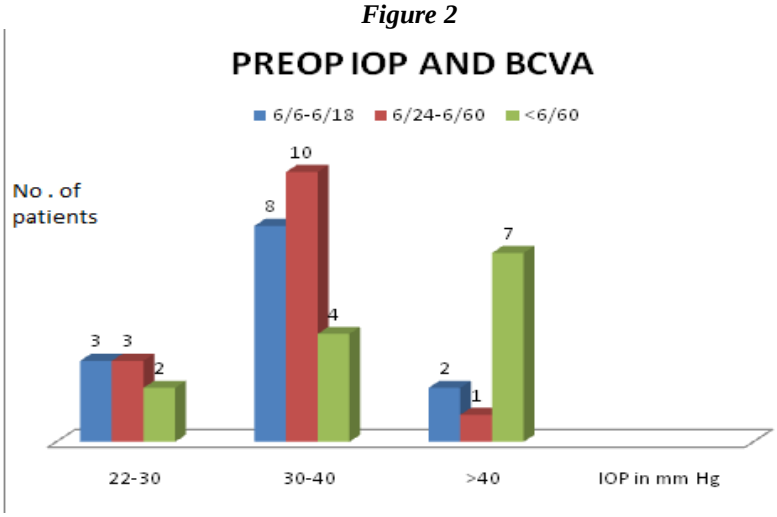


Pre operative IOP was compared with BCVA at 6 weeks (Table7),(Figure 2).Out of 8 cases which presented with IOP less than30 mm Hg, 3(37.5%) cases had good visual acuity at the end of 6 weeks . In 22 cases who presented with IOP between 31-40 mmHg 8 cases (36.36%) had good vision ,10(45.45%) cases had fairly useful vision and 4 (18.18%) cases with poor vision .Out of 10 cases with IOP more than 40mm Hg only 2(20%) had good visual acuity, 1(10%) with visual acuity of 6/24 – 6/60 , and 7 (70%) cases had poor vision . Out of 4 patients with optic atrophy three(75%) patients had IOP >40 mm Hg ._The correlation between height of IOP and visual outcome was, clinically significant but statistically not significant. ($\chi 2$ =8.9835, P value =0.615).

Preoperative IOP and Final BCVA Table 7

Pre operative IOP mmHg	FINAL BCVA		
	6/6-6/18	6/24/6/60	<6/60
22-30	3 (7.5%)	3(7.5%)	2 (5%)
31- 40	8 (20%)	10(25%)	4 (10%)
>40	2 (5%)	1(2.5%)	7 (17.5%)
Total	13 (32.5)	14 (35%)	13 (32.5%)

Figure 2



The better final BCVA is found when there is an early presentation and less IOP at the time of presentation.

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IV. Discussion

Lens induced glaucomas are commonly seen in India[8].Surgery for cataract is useful in these cases and has a good prognosis .The reason for delayed reporting in spite of services for cataract surgery available so easily appears to be poor health education, acceptance of poor vision as part of aging ,fear of operation, lesser expectations and socioeconomic constraints. It is very unfortunate that entity of LIG is still prevalent in developing countries like India and many people are becoming blind due to lack of awareness about importance of early reporting to ophthalmologist and further management.

This study is a retrospective case series study of 40 patients of lens induced glaucoma in a tertiary care centre in Palakkad district of Kerala state in South India . Analysis showed females were more affected than males similar to studies by Rijal et al,[9] Pradhan et al[10] and Prajna et al[11] They attributed this to the lesser attention received by old women for medical treatment in rural India and also the fact that anatomically, females have a shallower anterior chamber depth thus making them more prone for angle closure (Shibal Bhartia et al)[12].

The mean age of presentation was 64.5 years in our study. Similarly in M Sharanabasamma[13] study the mean age was 60.68 years, Shrestha R et al[14] study mean age was 61.5 years . In this study, 20 (50%) patients attended hospital for treatment within one week of onset of symptoms and 10(25%) patient sought medical treatment after 2 weeks. Pradhan et al[10] in his study found 70% cases reported for treatment after one week.

Similarly eye pain and redness were the main symptoms that brought the patients to the hospital in most of studies .All cases had poor vision of <1/60 at presentation .In the present study, BCVA at 6 weeks, 6/18 or better is comparable (32.5%) with Pradhan et al[10] study (31.40%) and Shrestha R et al[14] study (30.2%) but BCVA was less compared to M. Sharanabasama[13] (54%) and B.Ushalatha (80%)[15] study because in their study most patients attended within 10 days of symptoms .

Good visual acuity achieved, in cases presented within 1 week (50%) was more than the cases presented beyond 2 weeks (10%), whereas poor visual acuity of less than 6/60 was more in cases presented beyond 2 weeks (70%). There were a significant proportion of cases that had poor vision, with visual acuity less than 6/60 (30%) higher than Lahan study (21.0%).17.5% were blind with BCVA of<3/60 which is less compared to Pradhan et al where 21% were blind with BCVA of <3/60. Thus, in this study similar number of cases has achieved good visual recovery and higher number of cases had poor visual outcome when compared to Lahan study series[10]. BCVA in this study, of 6/18 or better was low (32.5%) and poor vision of less than 6/60 was higher (30%) compared to Madurai study, with 59.13% and 11.82% respectively[11]._More the delay in presentation, poorer was the visual outcome, which was both clinically and statistically significant (p=0.0146).

In an effort to study whether the mechanism of secondary glaucoma has any bearing on IOP, the following observations were made. Clinically (37.5%) with IOP at presentation less than 30 mmHg achieved good visual acuity, than cases with IOP more than 40 mm Hg (20%), whereas 70 % cases with IOP more than 40 mm Hg had poor outcome of less than 6/60 visual acuity. The higher the IOP at presentation the poorer the BCVA and the lower the IOP at presentation the better the visual acuity, similar to studies done by M Sharanabasamma[13] and Chandrasekhar G[16] .Madurai study[11] had found no statistically significant association between the level of preoperative IOP and final visual acuity. The IOP at last follow up was reduced to normal limits (17.3 4 ±5.54 mm Hg). This indicates that, in lens induced glaucomas IOP should be reduced by medical line of treatment preoperatively to as normal as possible, so as to achieve stable IOP post operatively with no further antiglaucoma medications.

All patients underwent SICS with and without IOL implantation. The success rate of surgery was higher compared to Malaysia study[17] because the duration of presentation in our study was earlier to Yaakub[18], Chandrasekhar G[16] and Mohinder S [19]. In Lahan study series, the percentage of optic atrophy cases (34.0%) is comparatively high from our study (10%).The poor visual acuity was seen mainly due to optic atrophy(57.14%). Prajna NV et al [11]and Rijal AP et al [9]also documented optic atrophy as the common cause of diminished visual acuity. These patients had longest time lag between development of symptoms and onset of treatment.

A study done by Dada T et al[20] used a different technique of sutureless single-port transconjunctival pars plana limited vitrectomy combined with phacoemulsification for management of phacomorphic glaucoma.

V. Conclusion

Lens Induced Glaucoma is disease of old age . It has to be diagnosed and treated early for good postoperative visual acuity since delay in treatment may lead to poor visual outcome. . The visual recovery was fairly good in all those cases that have undergone treatment quite early. Also the higher the IOP pre-operatively, the prognosis for good vision following surgery is poor. Therefore, there is great need for the awareness among rural elderly people even now about the importance of timely surgery of cataract for better visual outcome in this condition. Measures have to be taken to educate the rural population to understand the need of having reasonable good vision in the old age to lead an indepedent and healthy life. It is to be stressed upon, imparting health education and creating awareness regarding cataract and its implications among the rural community and peripheral health workers. Further the people should be made aware of the facilities available for early detection of LIG and to promote early treatment to minimize possible loss of vision.

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