

Clinical profile of lens induced glaucoma at a tertiary centre in north India

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Abstract

Introduction: To evaluate the clinical profile of Lens Induced Glaucoma (LIG) in remote hilly areas of Uttarakhand and determine the correlation of final visual outcome of such patients with preoperative rise of intraocular pressure (IOP) and their time of presentation.

Materials and Methods: A retrospective study was conducted on 63 eyes of 63 patients of senile cataract who were clinically diagnosed as LIGs and operated over a period of two years between August 2016 to July 2018 at SGRRIM & HS, Dehradun. The preoperative data was collected in terms of age, sex, type of LIG, time of presentation of the patient, visual acuity, OP and other clinical findings. Final outcome measure was the correlation of best corrected visual acuity (BCVA) at 6 weeks with preoperative rise of IOP and the time of presentation of patients.

Results: Majority of LIG patients were of phacomorphic glaucomas (66.7%) and in the sixth decade of life with female preponderance (2:1). Out of total 63 eyes, 39 eyes (61.9%) improved in vision after cataract surgery with majority of eyes in range of 6/60 to 6/24(47.6%) and 9 eyes (14.3%) had vision 6/18 or better at 6 weeks follow up. IOP control was less than or equal to 21 mm Hg in, 39 eyes (61.9%) at the time of discharge. The BCVA at 6 weeks was less than 6/60 in patients who presented late after one week ($\chi^2 = 14.841$, $p < 0.001$) and those who had high preoperative IOP range (53.79 +_19.85) and it was statistically significant. ($t = -4.247$, $p < 0.001$). The main causes of poor outcome were late presentation (33.3%), glaucomatous optic atrophy in 18 eyes (28.6%), persistent uveitis in 4 eyes (6.4%) and corneal decompensation in two eyes. (3.2%).

Conclusion: The results clearly 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 specially in remote hilly areas about the early diagnosis and treatment of visually disabling cataract and dangers of lens-induced glaucoma.

Keywords: Intraocular pressure, Lens induced glaucoma, Optic atrophy.

Introduction

According to a global estimation reported by a latest study published in The Lancet Global Health journal, 217 million people are in category of moderate to severe visual impairment and 36 million are practically blind world wide, out of whom 89% live in low and middle income countries and 55% are women. As many as 8.8 million people only in India were found to be blind and another 47.7 million had moderate to severe visual impairment.¹ Senile cataract is the most common cause of avoidable blindness in developing countries. The active implementation of the National Programme for Control of Blindness (NPCB), enthusiastic participation of NGOs, government hospitals and private eye setups has been successful to some extent in India, still there is a strong need to educate the public and create awareness especially in remote areas about timely cataract extraction to avoid danger of lens induced glaucoma. (LIG)

LIG is not a single entity but a group of disorders characterised by a secondary glaucoma with acute rise of intraocular pressure (IOP) and a hyper mature or rarely an immature senile cataract in one eye and normal IOP in the other eye, with a prompt relief of symptoms after cataract extraction in the affected eye.^{2,3} There are various modes of presentation of LIG which we are going to discuss later but the definite treatment is removal of the cataractous lens after medical control of intraocular pressure (IOP).^{4,5} Extensive search into the literature shows that there is much better visual outcome if patients of LIG are operated on time, otherwise the prognosis stands guarded due to increase in

preoperative duration of IOP rise ultimately resulting in glaucomatous optic atrophy. A number of studies have been conducted in the past on LIG but to the best of our knowledge not many, in this particular region of north India where there is altogether a different clinical demographic profile of rural, old and illiterate population belonging to remote hilly areas of Uttarakhand. The majority of population is short statured with small hypermetropic eyes, which is an important predisposing factor in LIG and the problem of transportation and therefore late reporting of these patients to tertiary centres, add on to the gravity of situation. Our basic purpose is to evaluate the correlation of final visual outcome with preoperative rise of intraocular pressure and the time of presentation of patients with LIG to the ophthalmologist.

Materials and Methods

A retrospective study was conducted on 63 eyes of 63 patients of senile cataract who were clinically diagnosed as LIGs and operated over a period of two years between August 2016 to July 2018 at SGRRIM&HS, Dehradun after due permission granted by ethics research committee of the institute.

All the patients enrolled in the study presented with symptoms of ocular pain, headache, blurred vision, perception of colored halos, nausea and vomiting. The clinical examination of the patients revealed significant increase in IOP, reduced visual acuity, circumciliary congestion, corneal oedema, shallow AC with cells and

flare, mid-dilated pupil and a hypermature or an immature senile cataract with either intact or a ruptured lens capsule. According to the various modes of presentation these patients were divided into five groups as phacomorphic, phacolytic, phacoantigenic, lens particle glaucoma and glaucoma secondary to anterior lens dislocation. 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.

The preoperative data was collected in terms of age, sex time of presentation of the patient, visual acuity (Snellen chart), IOP (Goldman applanation tonometry), and slit lamp examination findings. The gonioscopy and stereoscopic fundus findings were also recorded only in cases whenever it was possible due to clear media. Keratometry and biometry of the affected eye and the fellow eye was done whenever possible.

Majority of patients (40 eyes) underwent small incision cataract surgery (SICS) using sclerocorneal tunnel of 6 to 7 mm with rigid (PMMA) IOL implantation followed by 15 cases of clear corneal phacoemulsification (PHACO) with foldable IOLs (Auroflex), while plain SICS done in 7 eyes and intra capsular cataract extraction (ICCE) was performed in one case of anterior subluxation of lens and therefore 8 eyes were left aphakic. Peripheral iridectomy (PI) was done in all cases of secondary angle closure lens induced glaucoma.

The intraoperative and postoperative complications including presence of glaucomatous optic atrophy were documented. The postoperative evaluation was done in terms of control of IOP at the time of discharge (less than or equal to 21mm Hg), uncorrected visual acuity (UCVA) at day one and best corrected visual acuity (BCVA) at six weeks. The final outcome measure was the correlation of BCVA at six weeks with the time of presentation of the patients and the preoperative intraocular pressure (IOP) rise.

Statistical Analysis

The complete data was analysed using SSPV software. We used chi-square test for analysis of various parameters and statistical significance was set at 95% confidence intervals, that is at a p-value of <0.05. Bar diagrams were used to illustrate final outcome measures.

Results

Fig. 1 describes the clinical and demographic profile of the patients included in our study. The mean age group of our sample size of 63 patients was 62.48±12.88 years with a female preponderance (66.7%) as compared to males (33.3%). Majority of patients had phacomorphic glaucoma (42 eyes -66.7%), followed by phacolytic (15 eyes-23.8%), 3 cases of phacoantigenic (4.7%), 2 cases of lens particle glaucoma (3.2%) and one case of glaucoma due to anterior subluxation of lens (1.6%) (Figure-2) The average time of presentation of the patients was 4.95±3.31 days with maximum patients presenting within a week (66.7%). (Fig.

3) The average value of axial length was 21.15 ±3.07 mm and average IOL power was 23.95±2.43 dioptres indicating that majority of patients were hypermetropes. Majority of patients (40 eyes-63.4%) underwent small incision cataract surgery (SICS) with rigid (PMMA) IOL implantation followed by 15 cases (23.8%) of phacoemulsification with foldable IOLs (Auroflex), while plain SICS done in 7 eyes (11.1%) and intra capsular cataract extraction (ICCE) was performed in one case of anterior subluxation of lens (1.5%) and therefore 8 eyes (12.6%) were left aphakic. Out of total 63 eyes, 55 eyes (87.2%) received posterior chamber IOLs while none had implantation of AC IOLs. Peripheral iridectomy (PI) was done in all cases of secondary angle closure lens induced glaucoma. (68.2%) Table -1 demonstrate the comparison of preoperative BCVA, post-operative UCVA at day one and postoperative BCVA at 6 weeks. Preoperative BCVA was very poor in all the patients, it was less than 3/60 in 9 eyes (14.3%), hand movements close to face (HMCF) or just perception and projection of light (PL+ PR+) in 27 eyes each (42.9%). Post-operative UCVA at day one was again HMCF in majority of eyes (33 eyes – 52.4%), only 27 eyes (42.9%) gained better vision in range of 6/60 to 6/24 and 3 eyes (4.8%) had just PL+ PR accurate. However vision improved at 6 weeks follow up with majority of eyes (30 eyes-47.6%) gaining vision in range of 6/60 to 6/24 and 9 eyes (14.3%) had BCVA 6/18 or better. Therefore at final 6 weeks follow up out of total 63 eyes, 39 eyes (61.9%) improved in vision after cataract surgery, while 24 eyes (38.1%) remained severely visually impaired with vision less than 6/60 including 3 eyes (4.8%) with absent perception of light. Table -2 demonstrates the preoperative and post-operative IOP range. The mean preoperative IOP was 42.40±16.92 mm Hg which got controlled after lens extraction to an average of 21.95±3.16 mm Hg. Majority of eyes had IOP in range of 22-30 mm Hg (21 eyes – 33.3%), 18 eyes (28.6%) had IOP very high, > 50 mm Hg. Post operatively out of total 63 eyes, 39 eyes (61.9%) had good control of IOP ≤ 21 mm Hg, while in 24 eyes (38.1%) IOP still remained high in the range of 22-30 mm Hg which got controlled later by medical treatment. Finally BCVA at 6 weeks was correlated with preoperative IOP rise and time of presentation of the LIG patients. (Table 3, Fig. 4&5) The BCVA was < 6/60 in patients with high IOP range 53.79 ±19.85 and it was statistically significant (t = -4.247, p < 0.001). Out of total 63 patients, 42 presented within a week and 21 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. ($\chi^2 = 14.841$, p < 0.001) (Fig. 6&7) shows the complication profile of the patients during and after surgery. PCR occurred in 6 eyes (9.5%) with nucleus drop in one eye (1.6%) during prolapsed of nucleus in AC and capsulorrhexis extended in 4 eyes (6.3%). Out of 63 eyes, 8 eyes (12.7%) were left aphakic as IOL could not be implanted. Postoperative complications were mostly treatable including uveitis in 17 eyes (27%) and striate keratitis in 13 eyes (20.6%), but 18

eyes (28.6%) had glaucomatous optic atrophy and two eyes (3.2%) landed up in corneal decompensation.

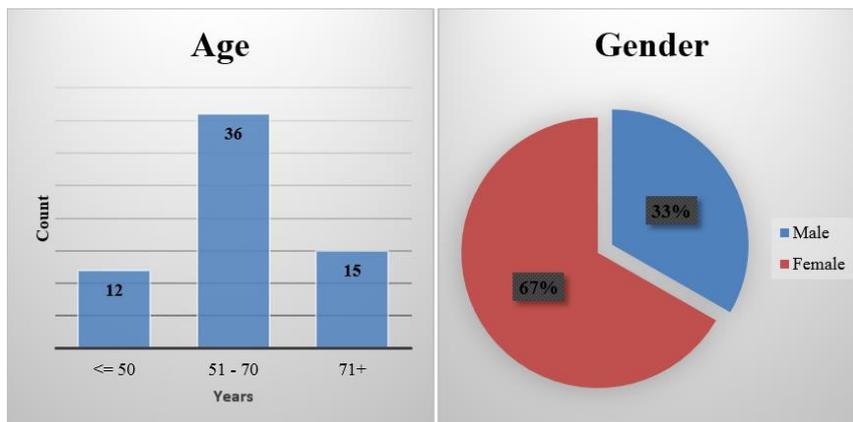


Fig. 1: Clinical and Socio-demographic variables

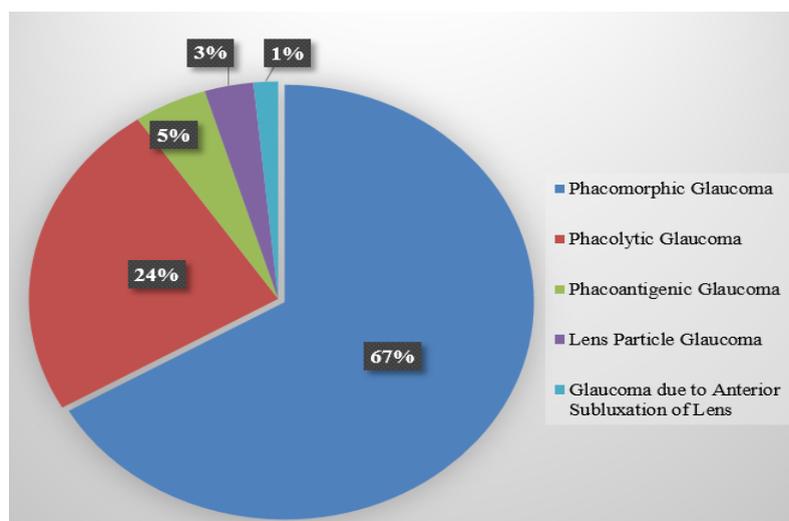


Fig. 2: Type of lens induced glaucoma

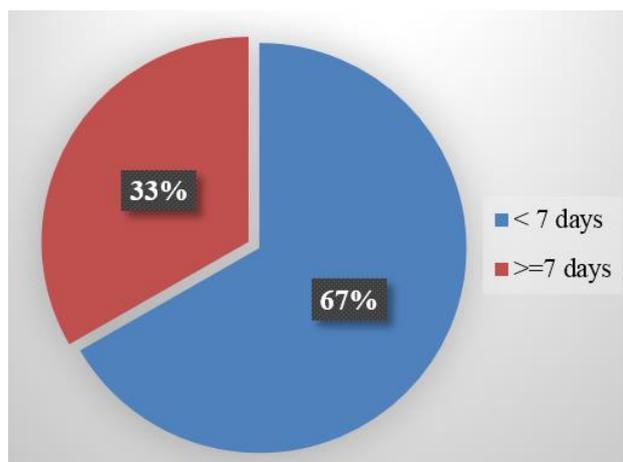


Fig. 3: Time of presentation of patients

Table 1: Preoperative and postoperative Visual acuity

Vision	Preoperative Best Corrected Visual Acuity	Post-operative Uncorrected Visual Acuity at 1 Day	Post-operative Best Corrected Visual Acuity at 6 Weeks
	N (%)	N (%)	N (%)
Better than 6/18	0 (0%)	0 (0%)	9 (14.3%)
6/24 – 6/60	0 (0%)	27 (42.9%)	30 (47.6%)
3/60	9 (14.3%)	0 (0%)	6 (9.5%)
HMCF	27 (42.9%)	33 (52.4%)	15 (23.8%)
PL+ PR-accurate	27 (42.9%)	3 (4.9%)	0 (0%)
PL Absent	0 (0%)	0 (0%)	3 (4.8%)

HMCF: hand movements close to face, PL: perception of light, PR : projection of light

Table 2: Preoperative and postoperative IOP

IOP (mmHg)	Preoperative IOP	Post-operative IOP
	Mean (SD) or N (%)	Mean (SD) or N (%)
Mean IOP	42.40 (16.92)	21.95 (3.16)
< 21	0 (0%)	39 (61.9%)
22-30	21 (33.3%)	24 (38.1%)
31-40	6 (9.5%)	0 (0%)
41-50	18 (28.6%)	0 (0%)
>50	18 (28.6%)	0 (0%)

IOP: intraocular pressure

Table 3: Correlation of BCVA at 6 weeks with Pre-operative IOP and time of Presentation

Variables	BCVA at 6 weeks \geq 6/60	BCVA at 6 weeks $<$ 6/60	Comparison (statistic, p-value)
	Mean (SD) or N	Mean (SD) or N	Independent sample t-test, Chi-squared test
Pre-operative IOP	35.39 (9.91)	53.79 (19.85)	t = -4.247, p < 0.001
Time of Presentation			
Within 7 days	33	9	$\chi^2 = 14.841$ p* < 0.001
After 7 days	6	15	

*= statistically significant

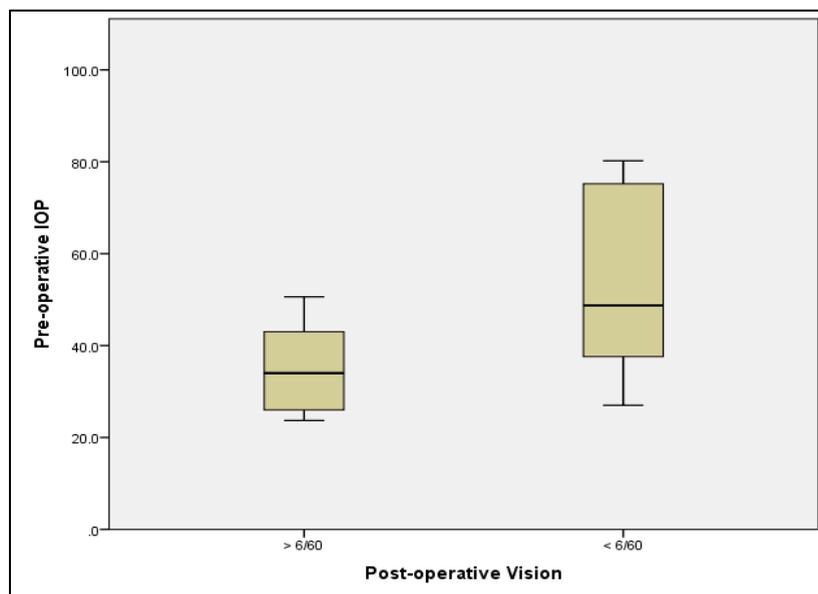


Fig. 4: Correlation of BCVA at 6 weeks with preoperative IOP

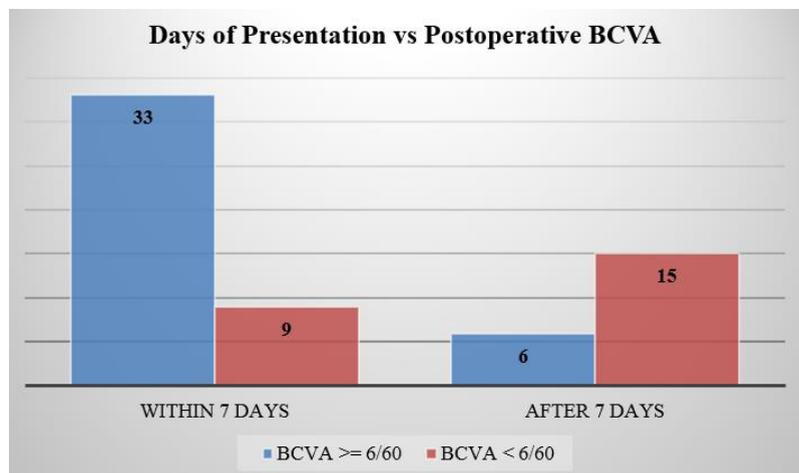


Fig. 5: Correlation of BCVA at 6weeks with time of presentation

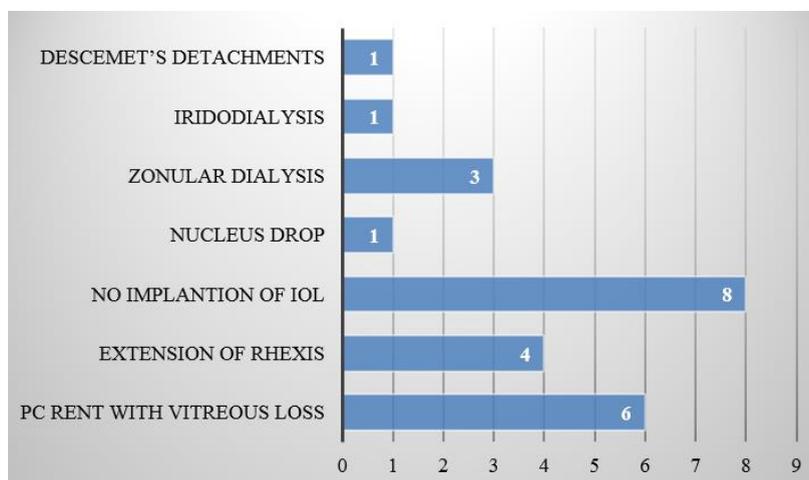


Fig. 6: Intraoperative complication profile

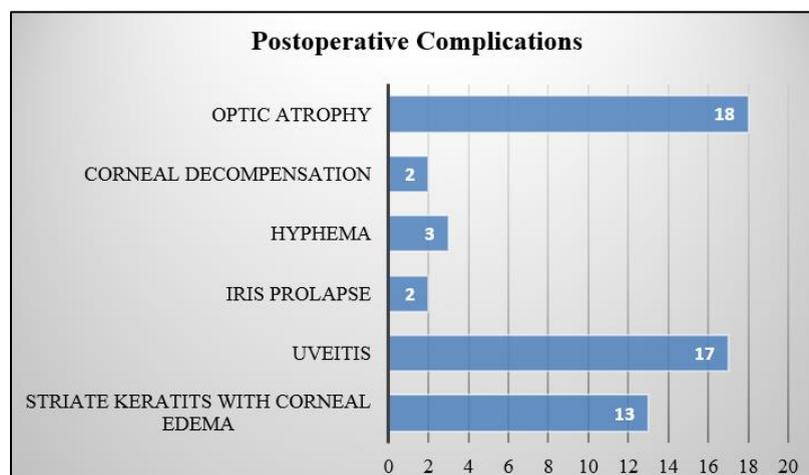


Fig. 7: Postoperative complication profile

Discussion

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. Lens -induced glaucoma comprises a number of different glaucomatous processes involving the role of the crystalline lens in elderly patients with both closed and open angle mechanisms of raised IOP.

Phacomorphic glaucoma is the most common variety of LIG with secondary angle closure mechanism. With aging the lens assumes increased anteroposterior length and swells up with weak zonules, leading to pupillary block especially in hypermetropic eyes. The presence of an intumescent cataractous lens with shallow AC in the affected eye and open angle in the other eye distinguishes it with primary angle-closure. Symptoms usually occur at night because mid-dilation predisposes relative pupillary block. Patient present with ocular pain, headache, blurred vision, perception of colored halos, nausea and vomiting due to significant rise in IOP. Sometimes bradycardia, and diaphoresis also occur due to the vasovagal response. The clinical examination of the patients reveals raised IOP as high as 80 mm hg at times, reduced visual acuity, circumciliary congestion, corneal edema, shallow AC with cells and flare, mid-dilated pupil and a hypermature intumescent cataract.^{6,7} Secondary angle-closure glaucoma may also occur if the lens is displaced from its normal anatomical position as seen in systemic disorders such as Weill-Marchesani syndrome, Marfan's syndrome and homocystinuria, the conditions with defective lens zonules (Ectopia lentis) or sometimes secondary to trauma.⁸⁻¹⁰

Lens induced glaucoma with secondary open-angle mechanism are phacolytic glaucoma, Lens particle glaucoma and phacoantigenic glaucoma. As proven by recent researches it is related to the role of heavy molecular proteins (HMW) leakage through the intact lens capsule of a mature or hypermature cataract resulting in the obstruction of the aqueous outflow and the role of the macrophages in phacolytic glaucoma is being de-emphasized as reported earlier.¹²⁻¹⁴ Another variety of secondary open angle glaucoma is Lens particle glaucoma in which obstruction of the trabecular meshwork is due to liberated fragments of lens material from ruptured capsule following cataract extraction, capsulotomy or penetrating trauma.¹⁵⁻¹⁷ The lens proteins which are kept in an immunologically privileged site within the lens capsule get exposed to the circulation, after an eye surgery or other trauma and recognized as foreign element inciting a fulminant inflammatory response which is supposed to be an Arthus type immune complex reaction mediated by IgG and the complement system. These events lead to the IOP rise in what we name as phacoantigenic glaucoma (formerly known was phacoanaphylactic). Clinical findings include keratic precipitates, synechiae, AC cells and flare and residual lens material.^{16,17} Initially when patient reports, IOP-lowering medications are used whatever variety of LIG is present. Topical beta blockers, carbonic anhydrase inhibitors, and hyperosmotic agents (mannitol IV) are the mainstay of medical treatment. Prostaglandin analogues are not preferred as they may increase AC reaction. Pilocarpine tend to increase pupillary block, so it should also be avoided. The mainstay of the treatment is lens extraction with complete cortical clean up.

In present study majority of LIG patients were in sixth decade of life with female preponderance (1:2) and phacomorphic glaucomas (66.7%) was the most common

variety. Most of the patients were hypermetropes with average AxL of 21.15 +_3.07 mm and average IOL power of 23.95+_2.43 D. Majority of eyes (87.2%) had IOL implantation while 8 eyes(12.7%) were left aphakic. Out of total 63 eyes, 39 eyes (61.9%) improved in vision after cataract surgery with majority of eyes in range of 6/60 to 6/24 (47.6%) and 9 eyes (14.3%) had vision 6/18 or better at 6 weeks follow up. IOP control was less than or equal to 21 mm Hg in 61.9% of eyes at the time of discharge. The BCVA at 6 weeks was less than 6/60 in patients who presented late after one week ($\chi^2 = 14.841$, $p < 0.001$) and those who had high preoperative IOP range (53.79 +_19.85) and it was statistically significant. ($t = -4.247$, $p < 0.001$) In spite of good surgery done, 24 eyes (38.1%) remained severely visually impaired including 3 eyes (4.8%) with absence of perception of light. The main causes of poor outcome were late presentation (33.3%), glaucomatous optic atrophy in 18 eyes (28.6%), persistent uveitis in 4 eyes (6.4%) and corneal decompensation in 2 eyes. (3.2%)

When we compare, one study reports the percentage of phacomorphic glaucomas (52.7%) slightly higher than phacolytic (47.3%) After surgical management, 57% of phacomorphic and 61% of phacolytic cases had good visual acuity (6/12 or better) and 10.2% of phacomorphic and 13.6% of phacolytic cases had poor visual recovery (6/60 or less).¹⁸ Another study done on a large sample size of 413 patients at Sagarmatha Choud hary Eye Hospital, Lahan, Nepal, reported 72% of phacomorphic cases and 28% of phacolytic glaucoma. At presentation the IOP was more than 30 mm Hg in 79% eyes but 80.7% of patients had IOP 21 mm Hg or less at discharge. About 38.6% achieved 6/60 or better, 31.2% less than 6/60, 30.2% less than 3/60. The main causes for poor outcome were optic atrophy in 34% eyes, uveitis in 26.6% eyes and corneal oedema in 25.5%. The reason was lack of money and no escort.¹⁹ Our study shows male to female sex ratio as 1:2 compared to a 12-week follow up study with 74% females and 26% of males. Most of the patients in this study (91%) had BCVA better than 6/60 after surgery, the reason was timely surgery.²⁰

Our study shows a statistically significant correlation between final visual outcome and preoperative rise in IOP and time of presentation of LIG patients ($p < 0.001$) similar to a study done in central India which reported better vision in patients who presented within 1 week (83.33%), whereas poor visual acuity of less than 6/60 was more in cases who presented beyond 2 weeks (25%). In this study, duration of symptoms had a linear relation with BCVA at final follow up. ($p=0.001$).²¹ Incidence in our study was similar to Jyoti et al who reported phacomorphic glaucoma (58.86%) compared to phacolytic glaucoma (33.33%) followed by 5.82% of lens particle glaucoma and 3.92% of glaucoma secondary to lens dislocation. 58.82% of cases achieved best-corrected visual acuity at the end of final follow up at 6 weeks with 35.29% cases achieved visual acuity between 6/18-6/60 and 5.88% regained visual acuity less than 6/60.²² We did SICS in 40eyes (63.4%) and PHACO in 15eyes (23.8%) with IOL implantation, while 8eyes(12.7%) were left aphakic as compared to studies done by Lee SJ et al and

Venkatesh R et al.^{3,5} A study done by Dada T et al used a different technique of sutureless single-port transconjunctival pars plana limited vitrectomy combined with phacoemulsification for management of phacomorphic glaucoma.² We had PCR in 6 eyes (9.5%) and extension of rhexis in 4 eyes (6.3%) and nucleus drop happened in one case (1.6%). The postoperative complications were mostly treatable except 18(28.6%) eyes with optic atrophy and two eyes (3.2%) with corneal decompensation. The complication profile was different in various studies as it lot depends on the competence of operating surgeon.²⁰⁻²²

The cataract surgery in LIG is a challenge always as AC remains shallow throughout, high upthrust, cornea is not clear at times, zonules are weak and capsular rhexis frequently extends in white cataracts, so it is very demoralising for the surgeon when patient does not gain vision post operatively due to optic atrophy inspite a difficult surgery done.

Conclusion

A combined effort of eye surgeons, optometrists, eye care health workers and the local village panchayats is required to decrease the incidence of vision threatening lens induced glaucoma in patients living in remote hilly areas who not only are ill informed but under privileged in terms of transportation and monetary situation. A sustained rise of pressure for a long time is a poor prognostic factor for post-operative good visual outcome in patients of LIG and therefore public awareness about timely surgery is of utmost importance, a role to be played by both government as well as non government organisations as we move on towards vision 2020.

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References

- Bourne R A, Flaxman S R. Magnitude, temporal trends and projections of the global prevalence of blindness and distance and near vision impairment: A systematic review and meta analysis. *Lancet Glob Health* 2017;5(9).
- Dada T, Kumar S, Gadia R, Aggarwal A, Gupta V, Sihota R. Sutureless single-port transconjunctival pars plana limited vitrectomy combined with phacoemulsification for management of phacomorphic glaucoma. *J Cataract Refract Surg* 2007;33:951-4.
- Venkatesh R, Tan CS, Kumar TT, Ravindran RD. Safety and efficacy of manual small incision cataract surgery for phacolytic glaucoma. *Br J Ophthalmol* 2007;91(3):279-81.
- Lane SS, Kopietz LA, Lindquist TD, Leavenworth N. Treatment of phacolytic glaucoma with extracapsular cataract extraction. *Ophthalmol* 1988;95(6):749-53.
- Lee SJ, Lee CK, Kim WS. Longterm therapeutic efficacy of phacoemulsification with intraocular lens implantation in patients with phacomorphic glaucoma. *J Cataract Refract Surg* 2010;36(5):783.
- Lowe R. Anterior lens displacement with age. *Br J Ophthalmol* 1970;54:117-21.
- Markowitz S, Morin D. Angle-closure glaucoma: relation between lens thickness, anterior chamber depth and age. *Can J Ophthalmol* 1984;19:300-2.
- Izquierdo NJ, Traboulsi EI, Enger C, Maumenee IH. Glaucoma in the Marfan syndrome. *Trans Am Ophthalmol Soc* 1992;90:111-7.
- Chu BS. Weill-Marchesani syndrome and secondary glaucoma associated with ectopia lentis. *Clin Exp Optom* 2006;89(2):95-9.
- Elkington AR, Freedman SS, Jay B, Wright P. Anterior dislocation of the lens in homocystinuria. *Br J Ophthalmol* 1973;57(5):325-9.
- Irvine SR, Irvine AR., Jr Lens-induced uveitis and glaucoma. I. Endophthalmitis phaco-anaphylactica. *Am J Ophthalmol* 1952;35:177-86.
- Yanoff M, Scheie HG. Cytology of human lens aspirate. Its relationship to phacolytic glaucoma and phacoanaphylactic endophthalmitis. *Arch Ophthalmol.* 1968;80:166-70.
- Flocks M, Littwin CS, Zimmerman LE. Phacolytic glaucoma: a clinicopathological study of 138 cases of glaucoma associated with hypermature cataract. *Arch Ophthalmol* 1955;54:37-45.
- Epstein DL, Jedziniak J, Grant WM. Identification of heavy molecular weight soluble protein in aqueous humor in human phacolytic glaucoma. *Invest Ophthalmol Vis Sci* 1978;17:398-402.
- Chu ER, Durkin SR, Keembiyage RD, Nathan F, Raymond G. Nineteen-year delayed-onset phacolytic uveitis following dislocation of the crystalline lens. *Can J Ophthalmol* 2009;44:112.
- Kee C, Lee S. Lens particle glaucoma occurring 15 years after cataract surgery. *Korean J Ophthalmol* 2001;15(2):137-9.
- Jain SS, Rao P, Nayak P, Kothari K. Posterior capsular dehiscence following blunt injury causing delayed onset lens particle glaucoma. *Indian J Ophthalmol* 2004;52(4):325-7.
- Prajna RV, Ramakrishnan R, Krishnadas R, Manoharan N. Lens-induced glaucomas-visual results and risk factors for final visual acuity. *Indian J Ophthalmol* 1996;44:149-55.
- Pradhan D, Hennig A, Kumar J, Foster A. A prospective study of 413 cases of lens-induced glaucoma in Nepal. *Indian J Ophthalmol* 2001 ;49(2):103-7.
- V Sree Kumar, E. Satya Narayana Murthy, B. Preethi. Clinical Study of Visual Prognosis in Lens Induced Glaucoma. *Int J Contemp Med Res* 2018;5(3).
- Raut N.G. Critical evaluation of lens induced glaucoma. *Med Res Chron* 2016;3(1):139-45.
- Bhuyan J, Bharali MD. Management of Lens Induced Glaucoma -A Clinical Study. *IOSR J Dent Med Sci (IOSR-JDMS)* 2016;15(8):76-82.

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