

Profile of secondary glaucoma cases in a tertiary eye care centre.

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Abstract:

Background: The aim of this study was to review the profile of secondary glaucoma cases visiting a tertiary eye care centre. To study causes and risk factors of secondary glaucoma, management strategies and outcomes in secondary glaucoma.

Methods: In this retrospective observational study, completed case records of patients with secondary glaucoma who presented to glaucoma clinic from 2009 to 2013 were included. Out of the 500 case records screened, 219 cases were found to eligible for inclusion in the study on the basis of follow up at least 6 months or more duration. The evaluation included a detailed history and examination performed including vision, anterior segment examination, intraocular pressure (IOP), gonioscopy and fundus evaluation. Diagnosis of secondary glaucoma was made on the basis of presence of a secondary cause for presence of raised IOP.

Results: 219 cases were eligible for inclusion in the study. Age distribution was as follows: 4.6% were between 0-20 years; 19.6% were between 21-40 years; 30.1% were between 41-60 years and 45.6% were >60 years. The male female ratio was 2.4:1. Frequent causes of secondary glaucoma were Uveitic 22.3%, post- vitrectomy 21.9%, steroid induced 10.9%, pseudophakic 10%, post traumatic 9.6%, neovascular 8.6% and lens induced 5%. On gonioscopy, 77.6% had open angles the rest had secondary angle closure. Post treatment visual improvement was seen in 15.9% cases. Pre –treatment mean IOP was 34.11 +/- 7.28 mmHg and post –treatment mean IOP was 16.49 +/- 4.80 mmHg. 83.1% cases were managed medically and rest cases underwent glaucoma surgeries. 19% cases required topical anti glaucoma therapy after surgery.

Conclusions: Most patients with secondary glaucoma have poor vision ($\leq 6/60$) with high IOP and at presentation. Assessment of underlying cause is the key guide to treatment strategy.

Keywords: Secondary glaucoma, glaucoma, tertiary centre, intra-ocular pressure.

I. Introduction

Glaucoma is the leading cause of global irreversible blindness.¹ The numbers are estimated to increase from 60.5 million people with OAG and ACG in 2010, to 79.6 million by 2020. By 2020, India will become second overall in number with glaucoma, surpassing Europe.² In recent years, there has been a rapid emergence of population-based studies in Asia, providing an opportunity to allow better estimation of global glaucoma prevalence. Considering Asia represents approximately 60% of world population, data from contemporary Asian studies may provide a more up-to-date estimation of global glaucoma prevalence.³⁻⁶

However, India still lacks epidemiologically valid data on various subtypes of glaucoma. Given the large geography and ethnic diversity, the pattern of glaucoma is bound to vary in different regions of India. Despite its public health significance, there is limited data available on the prevalence of secondary glaucoma and the possible risk factors for secondary glaucoma. The population-based Aravind comprehensive eye survey from south India reported a 0.7% incidence of secondary glaucomas, where the total prevalence of glaucoma was 2.6%, i.e. a third of all glaucoma cases.⁷

The aim of our study is to find the common causes, demographics and clinical features and outcomes of therapy in various secondary glaucomas in a tertiary eye care centre.

II. Materials and methods

We conducted this retrospective observational study, at Glaucoma Services, Nethradhama Superspeciality Eye Hospital, Bengaluru, India. 500 case records of patients who presented from the year 2009 to 2013 were reviewed. 219 eyes of 219 patients with completed records were found eligible for inclusion.

All the cases which had raised IOP (above 24 mm Hg) with or without glaucomatous optic neuropathy with signs of ocular trauma or inflammation or retinal pathology or previous ocular surgery and follow up of more than 6 months duration were included. Patient records which had densely scarred cornea or corneal edema or corneal degenerations or infectious keratitis (conditions precluding accurate IOP assessment) were excluded. The data collected included systemic and ocular history, best corrected visual acuity, significant anterior segment findings, IOP by Goldmann applanation tonometry, gonioscopy record and fundus findings.

III. Statistical analysis

We used descriptive and inferential statistical analysis for our study. Student t test (two tailed, dependent) was used to find the significance of study parameters on continuous scale with in each group. Paired Proportion test has been used to find the significance of proportion in paired data. The Statistical software namely SAS 9.2, SPSS 15.0 were used for analysis of data.

IV. Results

Case records of 500 patients referred to our glaucoma clinic from 2009 to 2013 were reviewed. 219 cases diagnosed as secondary glaucoma were found to be eligible for inclusion in the study. Of the 219 patients having secondary glaucoma, the age distribution was as follows: 4.6% were between 0-20 years; 19.6% were between 21-40 years; 30.1% were between 41-60 years and 45.6% were >60 years. The male to female ratio was 2.4:1. Most frequent causes of secondary glaucoma were, Uveitic 22.3%, Post-vitrectomy 21.9%, Steroid induced 10.9%, Pseudophakic 10%, Post traumatic 9.6%, Neovascular 8.6% and Lens induced 5%. (**Table- 1**)

On gonioscopy, 77.6% had open angles the rest had secondary synechial angle closure. Patients with more than 6 months duration of follow up were included in the study. The mean follow up duration in months was 24.99 ± 4.61 (Mean \pm SD). The visual acuity at presentation was $\leq 6/60$ in 45.7% of the cases. Post treatment visual improvement was seen in 15.9% cases, which was statistically significant with ($P=0.001$). Pre-treatment Mean IOP of 34.11 ± 7.28 mmHg reduced to 16.49 ± 4.80 mmHg post-treatment. Change in IOP from Pre-treatment to Post-treatment is depicted in the in **Table -2**, which showed a 51.65% reduction in IOP was seen from the pre-treatment to post-treatment.

83.1% cases were managed medically and 16.9% cases underwent glaucoma surgeries for IOP control (**Graph-1**).

Surgery for control of IOP was done in 38 cases, in the form of Trabeculectomy with mitomycin C in 52.6% (20 eyes), combined phacoemulsification with trabeculectomy with mitomycin C in 39.5% (15 eyes) and Ahmed glaucoma valve (AGV) implantation in 7.9% (3 eyes). (**Graph -2**)

Target IOP was achieved in 81% cases after surgery without any additional topical anti glaucoma therapy at 3 months follow up visit. 19% cases required additional topical anti glaucoma therapy after surgery.

Laser therapy in the form of Laser peripheral iridotomy, Selective Laser Trabeculoplasty and Transcleral cyclophotocoagulation (TSCPC) was done in 10 cases. Of which 90% cases required medical therapy post procedure.

Most common cause of secondary glaucoma was uveitic glaucoma which was seen in 49 eyes (22.3%). Amongst which 53.2% cases had secondary angle closure on gonioscopy, 63.8% were medically managed and 36.2% underwent surgery. One patient underwent Ahmed glaucoma valve implantation, and the others underwent trabeculectomy with mitomycin C.

Post vitrectomy secondary glaucoma was seen in 48 eyes (21.9%). Amongst which 6.25% had secondary synechial angle closure glaucoma. Silicon oil was retained for more than 3 months in 62% eyes. Medical management was successful in 95.8% cases, 4.2% cases required surgery in the form of trabeculectomy with mitomycin C.

Steroid Induced glaucoma was seen in 24 eyes (10.9%), due to topical steroids, systemic and intra vitreal steroids were amongst other modes of steroid usage observed in our study. 91.7% cases were medically managed, 2 cases required surgery in the form of trabeculectomy.

Pseudophakic glaucoma was seen in 22 eyes (10%), which were cases of complicated cataract surgery associated with posterior capsular rupture or secondary intra-ocular lens implantation. 18.2% cases required surgery in the form of trabeculectomy with mitomycin C, and one required Ahmed glaucoma valve implantation.

Post traumatic glaucoma was seen in 21 eyes (9.6%). Male preponderance was found, with male to female ratio of 9.5:1. 14.2% cases required surgery for IOP control, rest all cases were managed medically. All

cases followed blunt trauma with a clinical evidence of angle recession in 68% cases, seen in more than 2 quadrants on gonioscopy.

Neovascular Glaucoma was seen in 19 eyes (8.6%). Most common etiology was proliferative diabetic retinopathy in 12 eyes, central retinal vein occlusion in 5 eyes and Retinal detachment (post traumatic) in 2 eyes. 15.7% cases were refractory to medical treatment and underwent trans-scleral cyclophotocoagulation. One case underwent Ahmed glaucoma valve implantation.

Lens induced glaucoma was seen in 11 eyes (5%). Seven eyes were diagnosed with phacomorphic glaucoma, 3 eyes with phacolytic glaucoma and 1 eye with phacoanaphylactic glaucoma. Eight eyes (72.7%) underwent cataract surgery alone. Three eyes (27.3%) cases underwent combined phacoemulsification with trabeculectomy with mitomycin C.

Seven eyes (3.2%) had secondary glaucoma post penetrating keratoplasty. 4 eyes (57.1%) cases showed synechial angle closure. All cases were managed with topical anti glaucoma medication.

Six eyes (2.7%) were diagnosed with glaucoma secondary to pseudoexfoliation. Two (33.3%) cases underwent combined phacoemulsification with trabeculectomy with mitomycin C, rest all the cases were controlled with topical AGM.

Other miscellaneous causes like, 4 eyes (1.8%) had aphakic glaucoma in our study. All cases were following cataract surgery. All cases were controlled on topical anti – glaucoma medications. Two eyes (0.9%) post – scleral buckling for rhegmatogenous retinal detachment, 3 eyes (1.4%) Post intra- vitreal bevacizumab injection, with secondary glaucoma were managed with topical AGM. One eye (0.4%), post implantable collamer lens surgery with secondary glaucoma underwent YAG peripheral iridotomy (PI) and was controlled on topical AGM. 0.4% case post deep stromal automated endothelial keratoplasty (DSAEK) and 0.4 % case post deep anterior lamellar keratoplasty (DALK).

V. Discussion

Guidelines for management of primary glaucomas are more clear till date, but not for the management of secondary glaucomas. In our study we retrospectively analysed most common causes and management strategies adopted for secondary glaucoma in a tertiary eye care center so as to guide us further in possible preventive measures and improvising on therapeutic strategies. 219 eyes of 219 patients with follow up duration of 24.99 ± 4.61 months (Mean \pm SD) have been included. The population-based Aravind comprehensive eye survey from south India reported a 0.7% incidence of secondary glaucomas where the total prevalence of glaucoma was 2.6%, i.e. a third of all glaucoma cases.⁷ Another study from north India reports a 6.72% diagnosis of secondary glaucoma out of all glaucoma referrals in a five-year hospital-based retrospective analysis.⁸

Secondary glaucoma results from numerous ocular or systemic disorders and shows a poor IOP control with ocular hypotensive agents or filtering surgery. Thus early detection is important to maximize the chance of therapeutic response. Common causes of secondary glaucoma reported by Gadia *et al* were post vitrectomy (14%), trauma (13%), corneal pathology (12%), aphakia (11%), neovascular glaucoma (10%), pseudophakia (10%), steroid-induced glaucoma (8%), uveitic glaucoma (8%), and miscellaneous causes (14%).⁹ In another study 163 patients of secondary glaucoma accounted for 6.72%. The 5 most common causes for secondary glaucomas in their study were glaucoma secondary to adherent leucoma, aphakic and pseudophakic glaucoma, traumatic glaucoma, neovascular glaucoma and post-uveitic glaucomas.⁸

The etiology of secondary glaucoma cases reported in India has changed significantly from aphakic glaucoma being the most common cause seen in 37.7 % cases reported in study from north India done in 1982.¹⁰

In our study uveitic glaucoma was the most common occurrence, seen in 22.3 % cases followed by post – vitrectomy glaucoma seen in 21.9% cases. These conditions can lead to secondary glaucoma requiring advanced surgical treatment, which can be challenging because of the increased chances of inflammation post-operatively which can lead to subsequent surgical failure.¹¹ Ours being a tertiary eye care centre caters to all the patients referred for treatment. Hence, an increased number of uveitic glaucoma and post – vitrectomy glaucoma cases were seen. Shimizu *et al* reported a 9.73 % incidence of uveitic glaucoma in their study from 2001 to 2014.¹¹

Post – vitrectomy glaucoma was seen in 21.9 % cases in our study. Glaucoma is a frequent and often a refractory complication of pars plana vitrectomy with silicone oil injection and has a multifactorial etiology. Early silicone oil removal could prevent subsequent development of glaucoma. Inferior peripheral iridectomy in aphakic and pseudophakic eyes done routinely reduces the incidence of pupillary block glaucoma and displacement of the SO into the anterior chamber. Silicone oil emulsification is reduced by the use of pure silicone oil from which low-molecular weight silicone contaminants have been eliminated.¹² Aggressive medical and surgical management with SOR, shows modest success in controlling IOP. Honavare *et al*, in their study on secondary glaucoma after vitrectomy in Indian patients have shown glaucoma directly attributable to silicone oil in 70% cases of the cases which developed glaucoma post pars plana vitrectomy with silicone oil injection.¹²

Steroid induced glaucoma was seen in 10.9% cases in our study after topical, peri-ocular and intra-vitreal steroid administration. Careful monitoring of all patients on steroids is warranted.¹³ Steroid-induced response depends on the duration of therapy, type of steroids used, glycemic status as well as genetic influence of a person. Most of the cases included in this study had glaucomatous optic neuropathy due to long-term use of systemic and/or local steroids, indicating their late presentation to this hospital. In this respect, medical fraternity should be aware of the ocular side-effects of systemic steroids and the importance of regular follow-up with the ophthalmologist to detect the dreaded complication of raised IOP resulting in optic neuropathy.⁹

Pseudophakic glaucoma was seen in 10% cases. Study by Gadia et al in 2008 showed 6.8% cases of pseudophakic glaucoma among all the secondary glaucoma cases.⁹ Glaucoma after cataract surgery is most commonly seen due to intra-operative complication such as posterior capsular rupture, vitreous loss with or without secondary intraocular lens (IOL) implantation. So also in our case series all patients had a PC rupture intraoperatively. 8 cases had anterior chamber IOL, 4 cases had decentred posterior chamber IOL, 9 cases had posterior chamber IOL in sulcus and 1 case of retrofixated iris claw IOL. Declining trend of glaucoma after cataract surgery is seen due to improvement in micro-surgical instrumentation and better surgical techniques being adopted for cataract surgery.

Post traumatic glaucoma was most commonly seen in young males below 30 years of age in our study. Blunt trauma is commonly associated with angle recession. Glaucoma can develop immediately, or months or years later and cause optic nerve head damage. Study done by Ellong et al, reported an incidence of 4.2% compared to 9.6% cases of traumatic glaucomas seen in our study of secondary glaucomas. Damage to the iris or lens, vitreous hemorrhage, and inflammation on baseline examination has shown to be associated with a significantly greater risk of developing glaucoma after blunt or penetrating ocular trauma during later course of the disease.¹⁴⁻¹⁵

Lens induced glaucoma was seen in 5% cases in our study. The number has reduced significantly when compared to the previous reported incidences. Lens-induced glaucoma was reported as the most common cause of secondary glaucoma reported in Nepal.¹⁶ A declining trend is noted in our study is due to increased awareness about early cataract surgery and its benefits. Along with the above community based cataract awareness programmes and free surgical camps have contributed to the reduction in the number lens induced glaucoma cases.

Post – penetrating keratoplasty glaucoma was seen in 3.2% cases in our study. Lesser incidence of post – keratoplasty glaucoma was noted in our study possibly due to fewer number keratoplasty surgeries. Management of post – penetrating keratoplasty glaucoma is crucial, as high IOP can damage the optic nerve fibers as well as the endothelial cells of the corneal graft. Sharma et al reported 21% cases of Post PK glaucoma in their retrospective analysis of 445 eyes over a 9 year period.¹⁷

Pseudoexfoliation glaucoma was seen in 2.7% cases in our study. 33.3 % cases underwent managed surgically and the rest were managed medically. Pseudoexfoliation was associated with glaucoma in 1.1%, with ocular hypertension in 2.2%, in a study done in south Indian population over a period of 6 years. Rural and urban incidence vary significantly depending on the race and geographical distribution.¹⁸

Our study of secondary glaucoma cases helps to identify the common causes of secondary glaucoma. It gives us an insight into better screening methods, possible preventive measures and management strategies to treat secondary glaucomas. Limitations of our study are its retrospective study design and small sample size because of attrition in follow up. Treatment decisions were individualised on case to case basis.

VI. Conclusion

Incidence of secondary glaucoma varies widely in different levels of eye care facilities. Our study projects profile of secondary glaucoma in a tertiary eye care centre where more complicated and refractory cases are managed with a multi – speciality approach. Post treatment visual improvement was seen in 15.9 % cases. 83.1 % cases were managed medically and 16.9 % cases underwent glaucoma surgeries for IOP control. Surgery for control of IOP was done in the form of Trabeculectomy with mitomycin C in 52.6%, combined phacoemulsification with trabeculectomy with mitomycin C in 39.5% and AGV implantation in 7.9%. Target IOP was achieved in 81% cases after surgery without any additional topical anti glaucoma therapy. TSCPC was done in 10 cases. Identification of the underlying cause takes a priority, followed by possible preventive measures to be adopted to prevent adverse outcome. Long term well designed prospective studies on various subtypes of secondary glaucoma will throw more light on etiological causes and management protocols.

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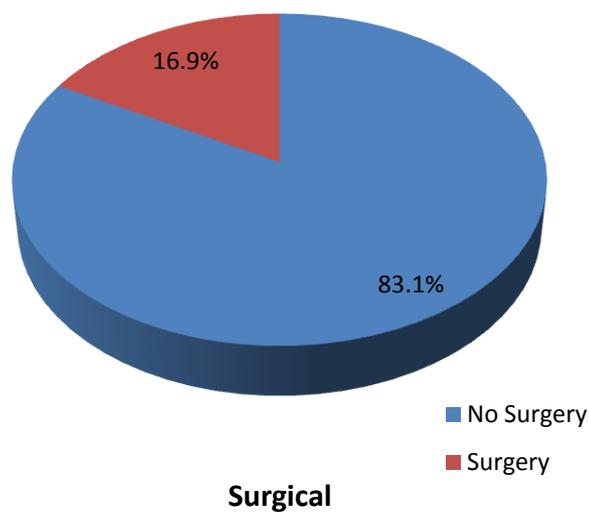
Table 1 – Table showing various causes, number of cases with sex distribution and management in various subtypes of secondary glaucoma.

Diagnosis	Gender		Medically controlled	Surgical management
	Female	Male		
Uveitic glaucoma	26	23	63.8%	36.2%
Post PPV	8	40	95.8%	4.2%
Steroid induced	9	15	91.7%	8.3%
Pseudophakic glaucoma	9	13	81.8%	18.2%
Post traumatic	2	19	85.8%	14.2%
NVG	2	17	84.3%	5.3%
Lens induced glaucoma	2	9	72.7%	27.3%
Post PK	3	4	100%	0
Pseudoexfoliation glaucoma	2	4	66.7%	33.3%
Aphakic glaucoma	2	2	100%	0
Post –intra vitreal bevacizumab	1	2	100%	0
Post – scleral buckling	0	2	100%	0
Post DALK	0	1	100%	0
Post DSAEK	0	1	100%	0
Post ICL	1	0	100%	0
Total	64	155		

Table 2- Comparison of pre and post treatment IOP

IOP	Min-Max	Mean ± SD	Difference	t value	P value
Pre	22.00-64.00	34.11±7.28	-	-	-
Post	8.00-40.00	16.49±4.80	17.616	31.911	<0.001**

Graph 1 – Distribution of medical and surgical management in our study.



Graph 2- Distribution of surgical management in study population.

