ASIAN JOURNAL OF PHARMACEUTICAL AND CLINICAL RESEARCH

INNOVARE ACADEMIC SCIENCES
Knowledge to Innovation

Vol 16, Issue 5, 2023

Online - 2455-3891
Print - 0974-2441

Research Article

PREVALENCE OF GLAUCOMA IN CATARACT PATIENTS - A COMPARISON BETWEEN PRE-COVID AND POST-COVID PERIODS

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Received: 19 February 2023, Revised and Accepted: 30 March 2023

ABSTRACT

Objectives: Globally, cataract and glaucoma are the predominant causes of blindness. Screening glaucoma in patients referred for cataract surgery is a convenient tool for detecting glaucoma cases in rural population. The COVID period has adversely affected eye care as the routine screening and follow-ups at hospital were substantially reduced owing to pandemic restrictions. We aim to study the impact of COVID on detection of glaucoma in patients with cataract.

Methods: It was a retrospective study conducted to compare the prevalence of glaucoma in rural patients presenting with cataract pre- and post-COVID. Details of 975 consecutive patients each were taken prior to March 2020 (pre-COVID) and after October 2021 (post-COVID) from hospital database and patient case files.

Results: The prevalence of glaucoma was higher during the pre-COVID time (3.8%) as compared to pre-COVID (3.8%), but the result was not statistically significant. In both the groups, primary open-angle glaucoma was the pre-dominant form of glaucoma, with prevalence being 1.5% and 2.2% in the pre-COVID and post-COVID groups, respectively. The mean intraocular pressure and mean VCDR values were higher in the post-COVID group as compared to the pre-COVID group, and the result was statistically significant.

Conclusion: This was the first study to compare the prevalence of glaucoma in patients with cataract in rural population in the pre-COVID and post-COVID periods. In the aftermath of the pandemic, the present study emphasizes the role of screening and follow-ups in glaucoma management to prevent irreversible loss of vision.

Keywords: COVID, Primary open-angle glaucoma, Glaucoma suspect, Cataract, Ocular hypertension

 DOI: http://dx.doi.org/10.22159/ajpcr.2023v16i5.47904. Journal homepage: https://innovareacademics.in/journals/index.php/ajpcr

INTRODUCTION

Cataract and glaucoma are the two most important reasons of blindness globally [1]. While cataract is the most important treatable blindness, the management of glaucoma depends on early detection appropriate management and follow-up. Open-angle glaucoma, the silent killer of sight, can present with symptoms when substantial RGC loss has already occurred. There are nearly 11.2 million persons older than 40 years with glaucoma in India, out of which more than half (6.48 million) are affected by primary open-angle glaucoma (POAG) [2]. As per Chennai Glaucoma Study, 39% of phakic patients with glaucoma had significant cataract and nearly 10% of those who had undertaken cataract surgery have already reported to diagnose with glaucoma. This study emphasizes the role of comprehensive eye examination prior to cataract surgery to improve the quality of cataract surgery [3]. Screening in patients referred from rural camps is an effective tool to diagnose the undetected glaucoma cases in the community.

The COVID period has adversely affected eye care as the routine screening and follow-ups at hospital were substantially reduced owing to pandemic restrictions. Various studies have highlighted the adverse impact of the pandemic on screening and follow-up of glaucoma patients, the main barriers being lockdown restrictions, transport difficulties, and financial problems. Apart from these factors, the reduced compliance to antiglaucoma drugs because of unavailability, financial constraints, and stress due to COVID [4,5] has affected the routine screening and consultation practices. We aim to explore the impact of COVID pandemic on prevalence of glaucoma in the underprivileged rural population with coexisting cataract. The present study aimed to determine the prevalence of glaucoma in rural patients being referred for cataract surgery and to compare the prevalence of glaucoma in rural cataract camp patient pre- and post-COVID periods.

METHODS

The current retrospective study was conducted on the patients being referred from rural camps to Hi-Tech Medical College and Hospital, Rourkela, for cataract surgery. The study was initiated after taking due approval from the Institutional Ethics Committee (IEC). In order to compare the prevalence of glaucoma in rural patients with cataract pre- and post-COVID periods, two sets of patients were selected from the hospital database. For the first group, 1000 consecutive patients were selected from the hospital database in a retrograde manner prior to February 2020. For this study, the period from March 2020 to October 2021 was considered a COVID period and no patients were considered during this period. The second set of patients included 1000 consecutive cataract patients referred to Hi-Tech Medical College for cataract surgery after October 2021.

For both the groups, demographic data and ophthalmic examination details of the patients were obtained from hospital database and case files and duly noted in the form of Excel sheets. As a part of standard protocol for cataract camp, initial screening included visual acuity, refraction, torchlight examination, and intraocular pressure (IOP) measurement with iCare tonometer. The patients referred undergo detailed history taking and ophthalmic and systemic examination. Ophthalmic examination includes visual acuity, slit-lamp examination, IOP measurement by Goldmann's applanation tonometry, gonioscopy, and fundus examination.

Van Herick's grading was used to assess peripheral anterior chamber depth and the angle of anterior chamber was graded according to Shaffer's grading using Sussman goniolens. Occludable angle was considered if pigmented trabecular was not visible in >270° of the angle

in dim illumination. IOP was measured using Goldmann's applanation tonometer, while in patients with corneal opacity, pterygium, or uncooperative patients, Schiotz tonometer was used.

Grading of lens opacities was done according to Lens Opacities Classification System II (LOCS II). Fundus examination was done with +90 D lens and indirect ophthalmoscope. Patients with retinopathy or other causes of vision loss apart from cataract or glaucoma were also excluded from both study populations. Perimetry was done wherever required.

Diagnostic criterion for glaucoma was done according to the International Society of Geographical and Epidemiological Ophthalmology (ISGEO) recommendations with certain study-specific definitions [6-9].

1. Suspicious disc changes: Vertical cup–disc ratio (VCDR) ≥0.6 or asymmetry of 0.2 between two eyes, or other changes such as focal notching, peripapillary splinter hemorrhage, or abnormal thinning of neuroretinal rim.
2. Abnormal IOP: IOP >21 mmHg in either eye or difference of 5 mmHg between two eyes
3. Field defect: Anderson's criterion used.
4. POAG: When two or more above condition (suspicious disc, abnormal IOP, or field defect) were fulfilled in the presence of open angle.
5. Primary angle-closure glaucoma: High IOP with or disc changes or field changes suggestive of glaucoma in the presence of occludable angle.
6. Primary angle closure: High IOP in the presence of occludable angle and absence of any other obvious cause.
7. Secondary glaucoma: IOP >21 mmHg in the presence of obvious cause.
8. Glaucoma suspects include:
   (a) Ocular hypertensive IOP >21 mmHg,
   (b) Disc suspect – VCDR >0.5, asymmetry of cup–disc ratio
9. Primary angle-closure suspect: Presence of occludable angle.

RESULTS

Out of 1000 patients, 975 patients were considered in pre-COVID due to incomplete details and equal number was selected in the post-COVID group. The mean age of patients in the pre-COVID group was 61.991±9.52. The post-COVID group was older (64.04±9.28 years). The average age of patients with both cataract and glaucoma was 66.78±7.76 and 64.27±9.7 years in the pre-COVID and post-COVID groups, respectively. The mean age difference for people with both cataract and glaucoma is highly significant with p<0.001 and t-test value 5.87 using independent samples t-test. The prevalence of glaucoma in the pre-COVID group was 2.9% as compared to 3.8% in the post-COVID group. In both the groups, POAG was the pre-dominant form, with prevalence being 1.5% and 2.2% in the pre-COVID and post-COVID groups, respectively (Table 1).

The mean right eye (RE) IOP was 14.59±4.15 mmHg and 14.99± 2.7 mmHg, while RE average cup–disc ratio was 0.37±–0.08 and 0.38±0.09 in the pre-COVID and post-COVID groups, respectively (Table 2). The mean IOP values were found to be significantly higher among post-COVID cases in both right (14.99+2.70; 95% CI: 0.09–0.71) and left (14.70+2.52; 95% CI: 0.47–0.92) eyes with p-values 0.01 and <0.001, respectively. Similarly, the mean VCDR values of both the eyes were found to be higher among the post-COVID cases (RE: 0.38+0.09; LE: 0.37+0.12) in comparison to that of pre-COVID cases (RE: 0.37+0.08; LE: 0.36+0.07). This finding was statistically significant with p=0.009 (95% CI: 0.002–0.018) (RE) and p<0.001 (95% CI: 0.007–0.026) (LE).

The association between prevalence of different types of glaucoma and glaucoma suspect in the pre-COVID and post-COVID groups is tabulated in Table 3. The prevalence of glaucoma was higher during the post-COVID time (3.8%) as compared to pre-COVID (2.7%), but the result was not statistically significant. As far as different types of glaucoma are considered, POAG was the pre-dominant form of glaucoma during the pre-COVID as well as post-COVID times, i.e., 1.5% and 2.2%, respectively. In both the groups, the prevalence of angle-closure glaucoma (ACG) and secondary glaucoma was nearly similar. The ratio of ACG to POAG was about 1:4 in both the pre-COVID and post-COVID groups with lens-induced glaucoma contributing to more than 50% of the secondary glaucomas. Although the prevalence of ocular hypertension and disc suspect was nearly double in the post-COVID group as compared to the pre-COVID group, it was not statistically significant.

DISCUSSION

The prevalence of glaucoma seems to vary from 2.6% to 3.45% in rural population >40 years as from different studies in India, all of the studies being conducted in the pre-COVID period [8-11]. Tomar *et al.* [7] reported that the prevalence of glaucoma in patients with cataract was found to be 3.7%. In our study, with similar subjects, the prevalence rate of glaucoma is amplified in the post-COVID period (3.8%) as compared to the pre-COVID period (2.9%), but it is not statistically significant (>0.05). The increase in post-COVID prevalence rate of glaucoma observed in our present study is mainly because of 2 reasons: one being decrease in detection of pre-existing glaucoma during COVID period due to decline in regular routine screening and the other being the rise in patients seeking medical help for vision impairment post-COVID restrictions. The lack of follow-up has also led to progression of glaucoma as the prevalence of advanced glaucomatous atrophy with no perception of light is 0.4% in post-COVID groups as associated with 0.1% in pre-COVID.

The prevalence of POAG is 1.5% in the pre-COVID group which is similar to Hooghly River Glaucoma Study (HRGS), Andhra Pradesh Eye Disease Study (APEDS), Chennai Glaucoma Study (CGS), and Aravind

Table 1: Prevalence of glaucoma/glaucoma suspects in the pre- and post-COVID groups

Type of glaucoma/glaucoma suspect	Pre-COVID		Post-COVID	
	Frequency	Prevalence (%)	Frequency	Prevalence (%)
POAG	15	1.5	21	2.1
NTG				
Primary angle closure	2	0.2	1	0.1
Primary angle-closure glaucoma	2	0.2	4	0.4
Angle-closure glaucoma	4	0.41	5	0.5
Secondary glaucoma	9	0.9	11	1.1
Lens-induced glaucoma	5	0.5	7	0.7
Total glaucoma	28	2.87	37	3.79
Ocular hypertension	5	0.5	10	1
Disc suspect	11	1.1	20	2
POAG suspect	16	1.64	30	3.07
Primary angle-closure suspect	13	1.3	9	0.92

POAG: Primary open-angle glaucoma, NTG: Normal tension glaucoma

Table 2: Mean difference in intraocular pressure measurement and vertical cup–disc ratio values among pre-COVID and post-COVID cases using independent samples *t*-test

Parameters	RE, mean±SD			LE, mean±SD		
	Pre-COVID	Post-COVID	95% CI	Pre-COVID	Post-COVID	95% CI
IOP	14.59±4.15 t: 2.544, p: 0.01	14.99±2.70	0.09–0.71	14.00±2.49 t: 6.145, *P*<0.001	14.70±2.52	0.47–0.92
VCDR	0.37±0.08 t: 2.634, p: 0.009	0.38±0.09	0.002–0.018	0.36±0.07 t: 3.614, p: <0.001	0.37±0.12	0.007–0.026

IOP: Intraocular pressure measurement, SD: Standard deviation, VCDR: Vertical cup–disc ratio, RE: Right eye, LE: Left eye, CI: Confidence interval

Table 3: Comparison between the pre- and post-COVID groups

Glaucoma/glaucoma suspect	Pre-COVID, n (%)	Post-COVID, n (%)	χ^2	p	95% CI
POAG	15 (1.5)	21 (2.2)	1.315	0.2515	0.53–1.97
PAC	2 (0.2)	1 (0.1)	0.325	0.5684	0.39–0.64
PACG	2 (0.2)	4 (0.4)	0.652	0.4195	0.39–0.85
ACG	4 (0.4)	5 (0.5)	0.109	0.7416	0.59–0.82
Secondary glaucoma	9 (0.9)	11 (1.1)	0.197	0.6573	0.75–1.17
Lens-induced glaucoma	5 (0.5)	7 (0.7)	0.327	0.5676	0.56–1.39
Total glaucoma	28 (2.8)	37 (3.8)	1.527	0.2166	0.60–2.63
Ocular hypertension	5 (0.5)	10 (1.0)	1.636	0.2008	0.32–1.39
Disc suspect	11 (1.1)	20 (2.1)	3.095	0.0785	0.13–2.20
PACS	13 (1.3)	9 (0.9)	0.717	0.3973	0.57–1.42

POAG: Primary open-angle glaucoma, PAC: Prevalence of angle closure, ACG: Angle-closure glaucoma, PACS: Primary angle-closure suspect, PACG: Prevalence of angle-closure glaucoma

Comprehensive Eye Survey (ACES) but lower than Central India Eye and Medical Study (CIEMS) (1.93%) [8,10-13]. In the post-COVID group, the prevalence of POAG rises to 2.2%, but it is not statistically significant.

In our study, the prevalence of angle-closure glaucoma (PAC and PACG) has 0.4% and 0.5%, respectively, in pre-COVID and post-COVID subjects which is much lower than 1.58% found in Chennai Glaucoma Study (CGS) and 1.15% seen in Hooghly River Study [8,14]. Our findings are, however, similar to ACES (0.5%) but higher than that found in CIEMS (0.24%) [10,11]. The prevalence of PACS was 1.3% and 0.9% in the pre-COVID and post-COVID groups correspondingly. The pre-COVID prevalence of PACS is similar to APEDS (1.5%) but much lower than in CGS (6.27%) [13,14]. The ratio of ACG to POAG was about 1:4 in both the pre-COVID and post-COVID groups. This is in dissimilarity to the report by Khandelwal *et al.* [15] studied in rural camp patients where the ratio was 1:1.2, with prevalence of ACG and POAG being 1.07% and 1.11%, respectively.

The prevalence of secondary glaucoma including pseudoexfoliation glaucoma (PEX) in both the pre-COVID (0.9%) and post-COVID (1.1%) groups is much higher than reported by Aravind (excluding PEX) and Hooghly River Study. The common type of secondary glaucoma is lens-induced glaucoma, comprising more than 50% of secondary glaucoma in both pre-COVID and post-COVID. A study done in South India by Rajendrababu *et al.* [16] has found lens-induced glaucoma as the common glaucoma emergency during the COVID period. The same study has shown that the percentage of true glaucoma emergency visits significantly improved by 62.4% (during COVID) in 2020 versus 2019.

In the pre-COVID subjects, the mean IOP in RE was 14.59±4.15 mmHg which is similar to CGS (14.29±3.32) and a similar study on cataract patients by Tomar *et al.* (14.42 mm Hg) but higher than CIEMS (13.8±3.5 mmHg). The mean VCDR in RE was 0.37±0.08 in the pre-COVID group which is similar to CGS (0.39±0.17) and HRGS (0.4±0.1) but lower than that found by CIEMS (0.55±0.12).

The mean IOP values were found to be significantly higher among post-COVID cases in both right (14.99+2.70; 95% CI: 0.09–0.71) and left (14.70+2.52; 95% CI: 0.47–0.92) eyes with p values 0.01 and <0.001 correspondingly. The rise in IOP may be attributed to either a lack of drug compliance in pre-existing glaucoma patients of COVID either due to non-availability of drug, financial difficulties, transport problems, or stress due to COVID [4,17]. Systemic steroids were used to reduce the inflammation and prevent complications in COVID-19 patients and they have a causal link with cataracts and glaucoma as shown by various studies [18-20]. In a study done by Bariş *et al.* in Turkey, the mean IOP had markedly increased and BCVA had markedly decreased in the post-lockdown period as compared to pre-lockdown visit [21]. In another multi-centric study done by Sevimli *et al.* [22] to observe the course of glaucoma progression after COVID treatment of patients, IOP and cup–disc ratio values were increased in previously diagnosed glaucoma patients post-COVID-19 infection. In our study also, the percentage of patients presenting with VCDR ≥ 0.8 increased from 0.2% to 1.5% in the post-COVID period.

CONCLUSION

This study seems to be the first study reported by us to compare the prevalence of glaucoma in patients with cataract in rural population in the pre-COVID and post-COVID periods. The limitation in our study was non-availability of pachymetry which would have provided better precision to IOP values in glaucoma and glaucoma suspects.

COVID-19 infections as well as lockdown restriction have adversely affected ophthalmic health care in general and glaucoma screening in particular. Glaucoma management mainly relies on 3 pillars: early diagnosis, treatment, and regular follow-up. Lack of transport facilities, government restriction, and shifting of focus health infrastructure to emergency services have led to a decrease in routine glaucoma screening, as well as follow-up of glaucoma patients. Inadequate follow-up as well as reduced availability of antiglaucoma drugs in rural areas coupled with financial problems and emotional stress may have led to non-compliance with prescribed drug regimen. This may have led to an increased prevalence of glaucoma as well as a progression of glaucoma as is evident by increased VCDR in the post-COVID period. Steroid use as an integral part of COVID management may also have played a role in the mean average rise in IOP in the post-COVID period. Screening glaucoma in patients referred from camps for cataract surgery can be an efficient tool in diagnosis in glaucoma in community. In the aftermath of the pandemic, present studies emphasize the role of screening and follow-up in glaucoma management to prevent irreversible loss of vision. Focus should be not only to emergency services but also to

routine eye care in the face of a similar situation. Finally, it also re-emphasizes the need for accessible eye care to outreach rural areas.

ACKNOWLEDGMENTS

None.

CONFLICT OF INTEREST

Nil.

FUNDING

Nil.

AUTHORS' CONTRIBUTIONS

Dr. Sujata Priyambada and Dr. Sitikantha Panda – Design and Data collection along with editing the manuscript. Dr. Sujata Priyambada and Dr. Sumanta Behera involved in analysis and interpretation of results, literature searching, manuscript writing, and submission.

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