Original Research Article

Prevalence, Types, and Steroid-Associated Risk Factors of Cataracts in Patients with Common Rheumatic Diseases: A Cross-Sectional, Hospital-Based Study in Rajshahi, Bangladesh

ABSTRACT

Background: Cataracts, a leading cause of global blindness, can develop in association with various rheumatic diseases, which primarily impact joints, bones, serosa, and tissues, including the eyes. The use of steroids in rheumatic diseases contributes to the emergence of posterior subcapsular cataracts. However, current research in this field is limited and necessitates further exploration.
Objectives: This study aimed to determine the prevalence and types of cataracts in patients with common rheumatic diseases and to investigate the association between the duration of steroid use and the development of cataracts.
Materials and Methods: A cross-sectional, hospital-based study was conducted in Rajshahi, Bangladesh, including 112 patients with common rheumatic diseases. Comprehensive information about each patient's health history, medications, and eye examinations was collected. Cataract types and grading were classified according to the Lens Opacities Classification System 3. Statistical analyses were performed to evaluate the association between rheumatic disease types, cataract development, and steroid use.
Results: The results revealed a higher prevalence of cataracts in females and patients within the 40-59 years age group. Posterior subcapsular cataracts were the most frequently occurring type, and a strong association was found between the duration of steroid use and cataract development.
Conclusions: Our study underscores the importance of regular ophthalmic examinations and interdisciplinary collaboration between rheumatologists and ophthalmologists in managing ocular health in patients with rheumatic diseases, especially those undergoing long-term steroid therapy. Further research is needed to better understand the underlying mechanisms of ocular involvement in rheumatic diseases and explore novel therapeutic approaches.

Keywords: Cataracts, Rheumatic diseases, Posterior subcapsular cataracts, Ophthalmic examinations, Interdisciplinary collaboration, Bangladesh

1. INTRODUCTION

Cataracts, characterized by a clouding of the eye's transparent lens, play a significant role in causing socio-medical challenges such as global blindness. Multiple factors contribute to the formation of cataracts, including genetic predisposition, the aging process, systemic illnesses, nutritional and metabolic issues, and rheumatic disorders.[1] The use of steroids is a crucial factor in the emergence of posterior subcapsular cataracts in association with various rheumatic diseases. These diseases commonly comprise Rheumatoid Arthritis, Systemic Lupus Erythematosus, Systemic Sclerosis, Spondyloarthropathy, Ankylosing Spondylitis, Osteoarthritis, Multiple Connective Tissue Disorders, Polymyalgia Rheumatica, and others.[2] With more than 200 identified rheumatic diseases, they primarily impact joints,

bones, serosa, and virtually all body systems, including tissues. Rheumatic diseases can manifest in the eyes as keratoconjunctivitis sicca, uveitis, episcleritis, scleritis, elevated intraocular pressure, and cataract formation, among others. One prevalent eye issue involving the lens is the development of cataracts. The majority of cataracts arise due to aging or injury to the lens tissue. Certain inherited genetic conditions that result in other health complications can also heighten the risk of cataracts. Cataracts can be induced by several eye-related issues, including past eye surgeries or diabetes mellitus. Prolonged usage of steroid drugs may also trigger the onset of cataracts.[3] Contributing factors heighten oxidative stress and ion pump disruptions, leading to abnormal lens epithelial cell proliferation and migration to the posterior pole region. Subsequently, chronic inflammation and other mechanisms related to premature aging encourage the formation of mature vacuolar or plaque posterior subcapsular cataracts.[4] Black RL, Oglesby RB, et al. revealed that 23% of rheumatoid arthritis patients treated with 10-16 mg prednisolone daily for at least a year and 75% of those treated with 16 mg prednisolone or more developed posterior subcapsular cataracts. No significant correlation was found between the patients' age, duration, and severity of Rheumatoid arthritis and cataract development in those not treated with corticosteroids, suggesting corticosteroids as a primary causative factor.[5] Current research in this field is limited and calls for more extensive studies for better diagnosis and treatment approaches.

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2. MATERIALS AND METHODS

2.1 Study Design and Setting

A cross-sectional, hospital-based study was conducted in Rajshahi, Bangladesh, from December 2021 to May 2022. The study included patients with rheumatic diseases attending the Rheumatic Department at Rajshahi Medical College.

2.2 Selection of Participants

A total of 112 patients with common rheumatic diseases were selected for the study.

2.3 Sample Size Calculation

The sample size for this study was determined based on the prevalence of rheumatic diseases and cataracts in the general population, as well as the desired level of precision and confidence interval. Using a standard formula for calculating sample size in cross-sectional studies:

$n=(Z^2\times P\times(1-P))/E^2$

where n is the required sample size, Z is the Z-score (1.96 for a 95% confidence interval), P is the estimated prevalence of rheumatic diseases and cataracts in the population, and E is the margin of error (precision).

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2.4 Inclusion criteria

1. Patients with common rheumatic diseases,
2. Adults aged 18 years or older, and
3. Both sexes.

2.5 Exclusion criteria

1. Pediatric patients and other causes of cataract cases, and
2. Patients with pre-existing ocular diseases.

2.6 Consent

Written informed consent was obtained from all participants prior to conducting the study.

2.7 Data Collection and Methodology

Patients diagnosed with common rheumatic diseases attending the Rheumatic Department at Rajshahi Medical College were included in the study. Comprehensive information about each patient's overall health, family history, medications, previous diseases, eye surgeries, and the date of their last eye examination were collected. The participants underwent a series of eye examinations, including visual acuity tests, cover tests, pupillary responses, slit-lamp examinations of the anterior segment (including the lens), retinal examinations, tonometry, and biometry. Cataract diagnosis was optimally performed using dilated-pupil slit-lamp examinations, which provided detailed information about the character, location, and extent of lenticular opacity.

2.8 Cataract Types and Grading

Three primary types of cataracts were identified and graded according to the Lens Opacities Classification System 3:

1. Nuclear sclerosis (NS): Cloudiness of the nucleus or central portion of the lens, observed by positioning the slit beam at a 30 to 45-degree angle.
2. Cortical cataract (CC): Spoke or wedge-like cloudiness observed during slit-lamp retro-illumination examination.
3. Posterior subcapsular cataract (PSC): Opacity in the posterior capsule of the lens, appearing as granular or plaque-like during oblique slit-lamp examination and black and vacuolated during slit-lamp retro-illumination examination.

2.9 Additional Eye Examinations

Retinal examination was conducted using direct and indirect retinoscopy, the anterior chamber angle was examined using gonioscopy, and intraocular pressure was measured with applanation tonometry.

Investigations

A variety of tests were performed, including routine blood examinations, ESR, routine urine examination, fasting and postprandial blood sugar levels, kidney and liver function tests, rheumatoid factor, antinuclear antibody, anti-citrullinated peptide, C-reactive protein, anti-double-stranded DNA, anti-Sm, antiphospholipid antibody, complement levels, HLA B27, chest X-ray, ECG, ultrasound, MRI, and A-scan biometry using the SRK2 formula.

Comment [M3]: Do you mean to state direct and indirect ophthalmoscopy?

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2.10 Statistical Analysis

Continuous data were expressed as mean ± standard deviation, and categorical variables were presented as proportions and percentages. Statistical significance was tested using the Chi-square test/Fisher's exact test. A p-value of less than 0.05 was considered statistically significant.

2.11 Statistical Analysis Formula

The data were analyzed using descriptive and inferential statistics. Continuous data were expressed as mean ± standard deviation, and categorical variables were presented as proportions and percentages. The association between categorical variables was tested using the Chi-square test or Fisher's exact test, as appropriate. A p-value of less than 0.05 was considered statistically significant.

The association between rheumatic disease types and cataract development was done by Chi-square test:

$\chi^2=\Sigma[(O_{ij}-E_{ij})^2/E_{ij}]$

where χ^2 is the Chi-square test statistic, O_{ij} is the observed frequency, and E_{ij} is the expected frequency under the null hypothesis (no association). If the calculated χ^2 value is greater than the critical value at a specified level of significance (e.g., 0.05), the null hypothesis is rejected, indicating a significant association between the variables.

3. RESULTS

In our study, we analyzed the distribution of age and gender among the participants (Table 1). A total of 112 individuals were included, with females comprising the majority of the sample (80.4%, n=90) and males representing a smaller proportion (19.6%, n=22). The age distribution was skewed towards the middle age groups, with the largest proportion of participants falling within the 40-59 age range (47.2%, n=52). The 20-39 age group accounted for 33.6% (n=37) of the sample, while the 60-79 and ≥80 age groups constituted smaller percentages, with 16.3% (n=18) and 1.8% (n=3) respectively. Only a negligible number of participants were in the youngest age group of 18-19 years (0.9%, n=2). These findings indicate a clear predominance of middle-aged and female participants in the study population, potentially limiting the generalizability of the results to a broader demographic.

Table 1: Distribution of Age and Gender

Age Group (in years)	Sex Female(n)	Sex Male(n)	Total(n)	Total(%)
18-19	0	2	2	0.9
20-39	31	6	37	33.6
40-59	46	6	52	47.2
60-79	11	7	18	16.3
More than or equal to 80	2	1	3	1.8
TOTAL	**90**	**22**	**112**	**100**

Table 2 presents the various ophthalmic manifestations observed in rheumatologic disorders among the 224 eyes examined in this study. The most common ocular complication was dry eye, accounting for 19.5% (n=43) of the cases. Uveitis was the second most prevalent manifestation, observed in 10.5% (n=23) of the eyes. Retinopathy was found in 7.7% (n=17) of the sample, followed by posterior subcapsular cataract in 7.3% (n=16) of the eyes. Less common manifestations included episcleritis, elevated intra-ocular pressure (IOP) of more than 21 mm Hg, and scleritis, with respective frequencies of 1.4% (n=3), 1.4% (n=3), and 0.9% (n=2). Overall, nearly half of the eyes (48.6%, n=107) exhibited some form of ocular involvement associated with rheumatologic disorders. These findings highlight the considerable impact of rheumatologic disorders on ocular health and emphasize the need for regular ophthalmic evaluations in patients with such conditions.

Table 2: Ophthalmic Manifestations in Rheumatologic Disorders

OCULAR INVOLVEMENT	Number of eyes (n=224)	Percentage (%)
Dry eye	43	19.50
Uveitis	23	10.5
Retinopathy	17	7.7
Episcleritis	3	1.4
Scleritis	2	0.9
Intra-ocular pressure more than 21 mm Hg	3	1.4
Posterior subcapsular cataract	16	7.3
Total	**107**	**48.6**

Table 3 presents the distribution of various types of cataract among the 224 eyes examined in patients with rheumatic diseases. The most frequently observed type was posterior subcapsular (PSC) cataract, accounting for 6.8% (n=15) of the cases. Nuclear sclerosis (NS) was the second most common type, found in 5% (n=11) of the eyes, followed by cortical

cataract (CC) in 4.1% (n=9). Mixed cataracts, characterized by the presence of multiple cataract types, were the least prevalent, affecting 2.4% (n=5) of the eyes. In total, 18.2% (n=40) of the eyes exhibited some form of cataract associated with rheumatic diseases. These findings underscore the importance of considering various cataract types when assessing ocular health in patients with rheumatic diseases.

Table 3: Among rheumatic diseases, there is a distribution of types of cataract.

Types of cataract	Number of eyes(n=224)	Percentage(%)
Posterior subcapsular(PSC)	15	6.8
Nuclear sclerosis (NS)	11	5
Cortical cataract (CC)	9	4.1
Mixed	5	2.4
Total	**40**	**18.2**

In Table 4, we examine the proportion of cataract gradings among the 224 eyes evaluated in this study. The cataracts were classified into four types: posterior subcapsular, nuclear sclerosis, cortical cataract, and mixed, with each type further categorized into four grades based on severity (Grade 1 to Grade 4).

For posterior subcapsular cataracts, there were no cases observed in Grade 1, while Grade 2 accounted for 3.64% (n=9) of the eyes, Grade 3 for 1.93% (n=5), and Grade 4 for 1.2% (n=3). Nuclear sclerosis showed no cases in Grades 1 and 3, with 1% (n=3) of the eyes classified as Grade 2 and 3.84% (n=9) as Grade 4. Cortical cataracts also had no cases in Grades 1 and 3, with 1% (n=3) of the eyes in Grade 2 and 2.12% (n=5) in Grade 4. Interestingly, mixed cataracts were observed exclusively in Grade 4, accounting for 2.12% (n=5) of the eyes. These findings reveal that among the various cataract types in patients with rheumatic diseases, more severe gradings (Grade 3 and Grade 4) were more common than milder ones (Grade 1 and Grade 2).

Table 4: The proportion of cataract gradings, based on a total of 224 eyes, is being considered.

Types of cataract	Gradel (Number)	Gradel (%)	Grade2 (Number)	Grade 2 (%)	Grade3 (Number)	Grade 3 (%)	Grade4 (Number)	Grade 4 (%)
Posterior subcapsular	0	0	9	3.64	5	1.93	3	1.2
Nuclear sclerosis	0	0	3	1.0	0	0	9	3.84
Cortical cataract	0	0	3	1.0	0	0	5	2.12
Mixed	**0**	**0**	**0**	**0**	**0**	**0**	**5**	**2.12**

Table 5 investigates the relationship between the duration of steroid use and the development of posterior subcapsular cataracts in patients with rheumatic diseases, based on a sample of 224 eyes. The study population was divided into four groups according to the duration of steroid use: 0-1 year, 1-5 years, 5-10 years, and more than 10 years.

Notably, none of the eyes in the 0-1 year group developed posterior subcapsular cataracts. However, as the duration of steroid use increased, so did the percentage of eyes with this

type of cataract. In the 1-5 years group, 2.7% (n=3) of the 77 eyes exhibited posterior subcapsular cataracts. This percentage increased to 6.9% (n=3) in the 5-10 years group, which included 59 eyes. The highest prevalence was observed in the group with more than 10 years of steroid use, with 10.2% (n=10) of the 79 eyes developing posterior subcapsular cataracts.

Table 5: The duration of steroid use is linked to posterior subcapsular cataract.

Duration of steroid (Years)	Number of eyes (Total eyes=224)	Cataract (Posterior subcapsular cataract)	Percentage (%)
0-1	5	-	0%
1-5	77	3	2.70%
5-10	59	3	6.90%
More than 10 years	**79**	**10**	**10.20%**

4. DISCUSSION

The present study aimed to analyze the distribution of age, gender, and ocular manifestations in rheumatologic disorders and their relationship with cataract types and steroid use.

Previous research by Mohammad Hasan Joker et al., which reported a mean age of 41.17 ± 39.70 years [7,8]. Our findings show a higher prevalence of rheumatic diseases among females, with a male to female ratio of 1:4, which is consistent with previous studies by Tore K.Kvein et al. (1:4-5) [9], Maryam H.Abdullahi et al. (1:4.3) [10], S.Laivoranta-Nyman et al. (1:3 for RA) [11], and Lai-Chu See et al. (1:3-4 times) [12]. The most common age group affected by rheumatic diseases was the 40-59 years age group, accounting for 47.2% of the cases.

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Regarding ocular involvement, dry eye was the most common manifestation (19.50%), followed by uveitis (10.5%) and retinopathy (7.7%). This is consistent with previous studies by S. Ausayakhun et al. (19.9%) [6] and Uribe-Reina P. et al. (15.93%) [13]. Among the cataract types, posterior subcapsular cataracts were most prevalent (6.8%), followed by nuclear sclerosis (5%) and cortical cataracts (4.1%).

Our study also examined the grading of cataract types and found that more severe gradings (Grade 3 and Grade 4) were more common than milder ones (Grade 1 and Grade 2). This is an important finding that highlights the need for early detection and intervention in patients with rheumatic diseases.

The duration of steroid use was found to be associated with the development of posterior subcapsular cataracts. [14,15] Patients with more than 10 years of steroid use had the highest prevalence (10.20%), while those with 5-10 years of use had a 6.90% prevalence, and those with 1-5 years had a 2.70% prevalence. No cataracts were found in patients with less than one year of steroid use. These findings suggest a relationship between the duration of steroid use and the development of posterior subcapsular cataracts, which is consistent with previous research by Robert G. Cumming et al. (6.3%) [16], J.H. TOOGOOD et al. (5.4%) [17], Andrew I. Jobling (4.7%) [18], Tinkleman et al. [19], and Nassif et al. [20].
Our study highlights the importance of regular ophthalmic monitoring for patients with rheumatic diseases, especially those on long-term steroid therapy. The findings also emphasize the need for further research to better understand the underlying mechanisms of

ocular involvement and cataract development in this population, as well as to explore potential therapeutic approaches tailored to specific cataract types and gradings.

5. CONCLUSION

Our study underscores the significant impact of rheumatic diseases on ocular health, with a higher prevalence observed among females and within the 40-59 years age group. The most common ocular manifestations include dry eye, uveitis, and retinopathy, with posterior subcapsular cataracts being the most frequently occurring cataract type. Furthermore, the study reveals a strong association between the duration of steroid use and the development of posterior subcapsular cataracts.

These findings highlight the crucial need for regular ophthalmic examinations and timely interventions for patients with rheumatic diseases, particularly those undergoing long-term steroid therapy. Our research emphasizes the importance of interdisciplinary collaboration between rheumatologists and ophthalmologists to ensure comprehensive care for these patients. Additionally, further studies are warranted to elucidate the underlying mechanisms of ocular involvement in rheumatic diseases and to explore novel therapeutic approaches that target specific cataract types and gradings. Ultimately, a better understanding of the pathophysiology and tailored management strategies could lead to improved ocular health outcomes for patients with rheumatic diseases.

ETHICAL APPROVAL

The ethical approval for this study was considered by the District Civil Surgeon Office, Rajshahi under Ministry of Health, Government of Peoples Republic of Bangladesh.

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