Comparative study of cataract in hypertensive patients and non-hypertensive patients

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Abstract

Introduction: The purpose behind conducting this study was to determine if hypertension increases the risk of cataract, to find out common morphological types of cataract in hypertensive patients, to determine relation between grade of hypertension and grade of nuclear sclerosis and to compare prevalence rates of cataract in hypertensive patients on anti-hypertensive drugs and those not on anti-hypertensive drugs.

Materials & Methods: Comparative study of cataract in hypertensive patients and non- hypertensive patients was crriedout in in Department of ophthalmology at Ashwini Rural Medical College, Kumbhari, Solapur with 300 eligible participants.

Results: This was a comparative study with 156 hypertensive and 144 non-hypertensive patients. Prevalence of cataract was found to be 79.53%. Prevalence of cataract was significantly higher in eyes of hypertensive patients as compared to eyes of non-hypertensive patients; (87.83% and 70.8% respectively, with p-value<0.0001). Significant association was found between high systolic BP and cataract. (χ^2=23.82, df= 1, p<0.0001). Nuclear cataract was the most common morphological type in eyes of hypertensive patients (50.4%). However, posterior sub capsular cataract was more common in eyes of hypertensive patients as in eyes of non-hypertensive patients (28.6% and 23.3%). No significant relation was found between grade of hypertension and grade of nuclear sclerosis (χ^2 = 4.33, df= 3, p=0.23). No significant difference between them was found in our study. (Z=0.10, p=0.92).

Conclusions: Risk of cataract is higher in hypertensive patients as compared to non-hypertensive patients. Relation between grade of hypertension and grade of nuclear sclerosis and role of anti- hypertensive drugs must be further explored.

Keywords: Cataract, Hypertension, Non-hypertensive patients, Risk factors, Prevalence

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Introduction

Blindness is a public health problem worldwide. According to WHO global data for visual impairments 2010, prevalence of blindness was 20.5%[1]. The prevalence rate is significantly higher in India when compared to Europe (7%) and America (8%). Almost all of the blindness (80%) is preventable[1,2]. Cataract is defined as any opacity in lens or capsule whether congenital or acquired. Cataract is the leading cause of blindness worldwide[3]. According to National Survey on blindness 2006-07, cataract is responsible for about 62.6% of all cases of blindness in India[4]. According to WHO cataract is responsible for nearly 50% of cases of blindness worldwide[1,5]. Nearly 12 to 15 million individuals are thought to be blind by cataract worldwide. Cataract occurs a decade earlier in India than the Western world[3]. According to Rapid Assessment of Avoidable Blindness-INDIA8 Report2006-07, (RAABI) 77.5 percent of blindness (vision <6/60) is caused by cataract[5]. The prevalence of blindness was observed to be 1.34 times higher in females compared to males.[5,6,7,8,9] It is also found that prevalence of blindness above 70 years to be 16 times higher than those aged 50-54 years[10]. Currently, the only treatment available for cataract is surgical extraction of the lens[11]. Hence it is important to study the possible risk factors for cataract. A better and detailed understanding of etio-pathogenesis of cataract can help us take appropriate measures to delay the onset of senile cataract. Hypertension is diagnosed by average awake systolic blood pressure >=140mmHg and/or diastolic blood pressure >=90mmHg according to American Heart Association[12]. According to a community based survey carried out by ICMR during 2007-08 prevalence of hypertension in India was 17 to 21% with marginal rural urban differences. Overall pattern of prevalence was found to be increasing with all age groups[4]. Hence it is important to study the effects of hypertension on the lens due to increasing morbidity of hypertension. Hypertension is known to be associated with ocular conditions like hypertensive retinopathy, ocular hypertension, etc.[13]. Various studies have been carried out in the past to study the relation between hypertension and cataract; however the need for further research has been put forth by most of them. Some of the previous epidemiological studies[14-25] indicate that hypertension plays an important role in development of cataract while some others do not.[11,26,27,28]

Patho-physiologic mechanisms of association of hypertension with cataract are however unclear and role

of oxidative stress, IL6, TNFα and elevated levels of C-reactive protein have been suggested[29]. Some of the past studies also state that associations may be due to confounding factors like smoking or diabetes mellitus[26]. Some epidemiological studies state that there is increased risk of cataract with high systolic but not diastolic blood pressure[26]. Some epidemiological studies have concluded that hypertension acts as a significant risk factor for Posterior sub-capsular cataract (PSC)[19]. Association between nuclear and cortical cataract and hypertension gave varied results in different epidemiological studies. Some studies suggest that hypertension is significantly associated with nuclear cataract[25], while some studies have concluded that hypertension is not significantly associated with nuclear cataract[19]. Results for association of cortical cataract with hypertension were found to be inconclusive by some studies[19]. Some of the previous studies have also concluded that people with severe hypertension had a greater risk of cataract[19]. The results of various studies of role of anti-hypertensive drugs and occurrence of cataract are conflicting. Some studies suggest that use of anti-hypertensive drugs can paradoxically promote cataract formation[30,31,32,33], while some others conclude that anti-hypertensive drugs have a protective effect on the lens[32]. Some other studies on the other hand suggest that use of anti-hypertensive drugs is not associated with any type of cataract[30].

The purpose behind conducting this study was to determine an independent relation between hypertension and cataract by eliminating major confounding factors like Diabetes Mellitus, smoking and alcoholism. Not many studies with respect to this subject have been carried out in the state of Maharashtra.

Materials and Methods

This comparative study was carried out according to the ethical principles for medical research involving human subjects defined by the 'Declaration of Helsinki'. An approval from the Institutional Ethics Committee (IEC) was obtained before starting the study. Study was done in department of Ophthalmology at Ashwini Rural Medical College, Kumbhari, Solapur a tertiary care hospital in Solapur distruct, during two months duration. Patients who fulfilled our inclusion criteria were included in the study, accordingly a total 300 patients were included.

Inclusion criteria:

1. Patients with age >=50 years visiting OPD of ophthalmology or general medicine of our institute
2. Patients who are willing to participate in the study.

Exclusion criteria:

1. Patients who do not give consent for this study.
2. Patients with age <50 years.
3. Diabetic patients(Random blood sugar>200mg/dl)[34] as well as known cases of Diabetes Mellitus.
4. Patients who are smokers and/or consume alcohol.

This was a comparative study consisting of 300 patients. One group was classified as 'hypertensive' and the other group being 'non-hypertensive'.

Systolic and diastolic blood pressure of all eligible patients was measured (after allowing them to rest for at least five minutes before measuring blood pressure) using a mercury sphygmomanometer in right arm sitting position using a cuff of appropriate size. The blood pressure recorded was graded as follows.[34,35]

Blood Pressure classification	Systolic mmHg	Diastolic mmHg
Normal	<120	And<80
Pre-hypertension	120-139	Or 80-89
Stage 1	140-159	Or 90-99
Stage 2	>160	Or>100
Isolated systolic	>140	And<90

Statistical analysis

Descriptive statistics such as mean, SD and percentage were used. Comparison between groups was done by using z-test for proportion. Chi-square test was used to find out association between categorical variables. A p-value less than 0.05 were considered as significant. Data was analyzed using MS-excel.

Results

At the end of study duration, we got 300 participants for our study who were examined and interviewed for all the parameters in our questionnaire.

Table 1: Distribution of hypertensive and no-hypertensive cases

	No. of cases	Percentage
Hypertensive	156	52
Non-hypertensive	144	48
Total	300	100

Out of 300 patients, 156 (52%) were hypertensive and 144 (48%) were non-hypertensive.

Table 2: Prevalence of cataract in 'eyes' of study population

	No. of cases	Percentage
Cataract	408	79.53
Clear lens	105	20.47
Total	513	100

Total 600 eyes of 300 patients were examined. We excluded 'eyes' previously operated for cataract and corneal opacities. Hence, we examined total 513 'eligible eyes'. Out of these, cataract was detected in 408 eyes. Hence prevalence of cataract was 79.53%.

Table 3: Comparison of prevalence of cataract in eyes of hypertensive and non-hypertensive patients

Cataract	Eyes of Hypertensive Patients (%)	Eyes of Non-hypertensive Patients (%)	Total
Present	231 (87.83)	177 (70.8)	408
Absent	32 (12.17)	73 (29.2)	105
Total	263	250	513

Z=4.85, p<0.0001

Out of 513 eyes, 263 eyes were of hypertensive patients and 250 eyes were of non-hypertensive patients. Cataract was seen in 231 eyes of hypertensive patients and 177 eyes of non-hypertensive patients. Hence, Prevalence of cataract in eyes of hypertensive patients was 87.83% (231/263) Prevalence of cataract in eyes of non-hypertensive patients was 70.8% (177/250).

From the above table, prevalence of cataract was observed more in eyes of hypertensive patients (87.83%) than eyes of non-hypertensive patients (70.8%) and also found that, there is highly statistical significant difference between prevalence of cataract in eyes of hypertensive and non- hypertensive patients (p<0.0001). Hence our research hypothesis was accepted.

Table 4: Morphological types of cataract in eyes of hypertensive and non-hypertensive patients

Type of morphology	Eyes of HTN patients (%)	Eyes of Non-HTN patients (%)	Total
Anterior capsular	3 (0.9)	1 (0.4)	4
Brown cataract	6 (1.8)	7 (2.8)	13
Cortical	31 (9.1)	27 (10.7)	58
Nuclear	171 (50.4)	127 (50.19)	298
PSC	97 (28.6)	59 (23.3)	156
Total mature cataract	22 (6.5)	24 (9.5)	46
Hyper mature cataract	0 (0)	1 (0.4)	1
Total	330 (100)	246 (100)	576

Based on the morphology of cataract detected on slit lamp examination, we determined the most common morphological type of cataract in hypertensive patients. In cases of mixed cataracts, each of the morphological types was considered separately.

It is observed that, Nuclear cataract was found to be most common morphological type of cataract in eyes of hypertensive patients (171 eyes; either purely nuclear or in combination with other morphological types). This was followed by posterior sub capsular (PSC; 28.6%) and cortical cataract (9.1%).

Similar pattern was seen in non-hypertensive patients; however, prevalence of posterior sub- capsular cataract was higher in hypertensive patients than non-hypertensive patients. (28.6% against 23.3%).

Discussion

Cataract and hypertension: From the above results, we have found that prevalence of cataract is significantly higher in hypertensive patients (87.83%) as compared to non-hypertensive patients (70.8%). This difference in prevalence is independent of confounding factors such as diabetes mellitus, smoking and alcoholism. Hence, our first research hypothesis i.e. 'There is significant difference in the prevalence rates of cataract in hypertensive patients and non-hypertensive patients' is supported. Hence, risk of cataract is more in hypertensive people than non-hypertensive people. M Sharma, et. al[27] also found a higher prevalence of cataract in hypertensives (74%) as compared to non-hypertensives (69.8%). However, this difference was not found to be statistically significant. Similar to our study, many of the previous studies found hypertension as a significant risk factor for development of cataract[14-25].

Consistent with results by Schaumberg, et. al[26], Xiaoning Yu, et.al[19], we have found high systolic blood pressure as a risk factor for cataract.

Some studies[11,26,27,28] however did not find hypertension as a risk factor with cataract.

Patho-physiological mechanisms of role of hypertension in development of cataract is not clear. A study by Bautista LE, et. al[29]; has found that elevated plasma levels of IL-6 and TNF-a appeared in individuals with high blood pressure (Systolic BP>=140mmHg or diastolic BP>=90mmHg). A study by Virgolici B, et. al[36] revealed that senile cataract is a systemic disease with an inflammatory component. Hence, role of hypertension in development of cataract can possibly be explained by raised inflammatory markers in hypertension.

A study by J Kaur, et. al[37] have found that oxidative stress plays an important role in onset and progression

of cataract. In a study by Briones AM, et. al.[38] role of oxidative stress in hypertension was found. Hence, role of hypertension in development of cataract can be attributed to oxidative stress.

In a study by Flipovsky et. al[39] it was found in their studies that cortisol levels are significantly higher in men with high systolic blood pressure than diastolic blood pressure. This can possibly explain association of high systolic blood pressure with cataract; as corticosteroids are known to cause cataract[3].

Lee SM, et. al[40] have found in their study that systemic hypertension induces change in the protein conformational structures of the lens capsule, then cause altered membrane transport and permeability of ions and result in exacerbation of cataract formation. This could be one of the mechanisms by which hypertension plays a role in cataract formation.

A study by Smith PA, et. al[41] has revealed that sympathetic hyperactivity play an integral role in the development of hypertension and it's complications. Similar results were found by Masuo K, et. al[42] who conducted studies on heightened sympathetic nervous system activity contribute to elevation of blood pressure.

Churchill GC, et. al[43] have reported presence of α 1A adrenergic receptors in the lens. It is not known if these play a role in cataract formation, however the role of these can be explored in the future.

Common morphology of cataract: We found nuclear cataract most common morphological type in our study. This was seen in both hypertensive as well as non-hypertensive patients. This finding of our study is consistent with study by Tsai, et. al[21].

The prevalence rates of nuclear cataracts were however nearly equal in hypertensive and non-hypertensive patients. (50.4% and 50.19% respectively).

Posterior sub-capsular was the next common type. The prevalence of posterior sub capsular cataract was higher in hypertensives (28.6%) as compared to non-hypertensives (23.3%). Tsai, et. al[21] however found prevalence of cortical cataract higher than that of posterior sub capsular cataract in their study (12.9% and 9.2% respectively). This can probably be so as we had excluded diabetic patients from our study. A Study by Neil Rowe, et.al[44] had found diabetes as a risk factor for cortical cataract.

Higher prevalence of posterior sub capsular cataract in hypertensive patients can possibly be due to higher level of corticosteroids in hypertensive patients as compared to non-hypertensive patients. Harold Skalka et. al[45] have found posterior sub capsular cataract to be significantly associated with corticosteroids.

Conclusion

From our study, we have concluded that prevalence of cataract is significantly higher in hypertensive patients as compared to non-hypertensive patients. There is significant association of high systolic blood pressure with cataract. Hence, high systolic blood pressure acts as a significant risk factor for cataract. Also, there is increased risk of cataract in hypertensive patients as compared to non-hypertensive patients.

Nuclear cataract is the most common morphological type seen in hypertensive patients; however there was a difference in prevalence of posterior sub capsular cataract in eyes of hypertensive and non-hypertensive patients (28.6% and 23.3%). The relation between grade of hypertension and grade of nuclear hardness (nuclear sclerosis) was not found to be significant in our study. Further research will be needed on this topic after matching for factors like age.

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