

## Prevalence and Risk Factors of Hypertensive Retinopathy in Hypertensive Patients

Ratindra Nath Mondal<sup>1\*</sup>, Md Abdul Matin<sup>2</sup>, Moni Rani<sup>2</sup>, Md. Zakir Hossain<sup>2</sup>, Amaresh Chandra Shaha<sup>1</sup>, Ram B Singh<sup>3</sup>, Md. Foyjul Islam<sup>4</sup> and Anupom Das<sup>1</sup>

<sup>1</sup>Rangpur Community Medical College, Rangpur, Bangladesh

<sup>2</sup>Rangpur Medical College, Rangpur, Bangladesh

<sup>3</sup>Halberg Hospital and Research Institute, Moradabad, India

<sup>4</sup>Tmss Medical College Hospital, Gokul, Bangladesh

\*Corresponding author: Ratindra Nath Mondal, Associate Professor of Medicine, Hypertension and Research Center, Rangpur, Rangpur Community Medical College, Rangpur, Bangladesh, Tel: +880 521-61116; E-mail: [dr.ratinmondal@gmail.com](mailto:dr.ratinmondal@gmail.com)

Received date: May 27, 2017; Accepted date: June 12, 2017; Published date: June 17, 2017

Copyright: © 2017 Mondal RN, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License; which permits unrestricted use; distribution; and reproduction in any medium; provided the original author and source are credited.

### Abstract

**Background:** Hypertensive retinopathy is one of the major complications of hypertension. Presence of hypertensive retinopathy may be an indicator of presence of other complications of hypertension, commonly nephropathy.

**Subjects and methods:** This study was carried out in OPD of Hypertension and Research Center, Rangpur, Bangladesh. It was a cross sectional study, systemic sampling method was used to generate the sample of 384 patients.

**Results:** Out of 313 hypertensive patients, male were found preponderance (66.1% vs. 33.9%), mean age was 51.80 years. 29.4% (92) patients had hypertensive retinopathy of different grades. Majority (14.7%) of the patient had grade 1 hypertensive retinopathy. Average time required to develop retinopathy was 6.73 years (minimum 3 month, maximum 30 years). Mean age of the patients with hypertensive retinopathy was 55.10 years. Hypertensive retinopathy was significantly higher in >50 years age than <50 years age (68.48% vs. 31.52%) (P value=0.0004779), male sex (64.1% vs. 35.9%) and higher in those with duration of hypertension more than 5 years (34.56% vs. 23.84%) (P-value=0.0000251). Other target organ damage (IHD, stroke and CKD) was more in those with retinopathy than without retinopathy patients (21.73% vs. 19.90%).

**Conclusion:** In our study more than one fourth of the hypertensive patients had hypertensive retinopathy. Male sex, increasing age (>60 years) and longer duration of hypertension (>5 years) were positively correlated with hypertensive retinopathy.

**Keywords:** Hypertensive patients; Retinopathy; Angiography; Cardiovascular risks; Systolic blood pressure; Nephropathy; Chronic renal failure

### Introduction

Hypertension affects nearly 26 per cent of the adult population worldwide. Kearney and colleagues estimated that the prevalence of hypertension in 2000 was 26% of the adult population globally and that in 2025 the prevalence would increase by 24% in developed countries and 80% in developing countries [1]. In Bangladesh a nationwide survey in 2010 revealed prevalence of hypertension 17.9% [2]. Hypertension has been reported to be responsible for 57 per cent of all stroke deaths and 24 per cent of all cardiovascular deaths in East Asians [3] Ratindra et al. has shown that 71.2% of the hypertensive patients died due to hypertensive related complications (33.3% due to stroke, 20.3% CAD and 17.8% chronic renal failure) [4]. Because of the high prevalence of this condition and the increased morbidity and mortality associated with this condition, the economic cost of hypertensive disease was estimated at \$76.6 billion in 2010 [5]. Eyes are proven hypertensive target organs [6]. The clinical importance of

cardiovascular risk factors staging in hypertensive patients is based on retinopathy changes [7]. Some ophthalmoscopic findings are helpful in evaluating the duration, severity, predictions or hypertension vasculopathy effects [8]. Retinal microvascular changes are signs of hypertensive retinopathy and can be useful to classify risk factors and treatment decisions for hypertension [9].

So, earlier detection of hypertensive patients who are in risk to develop target organ damage is very important. In this study we are going to estimate the prevalence and risk factors of hypertensive retinopathy.

### Patients and Methods

This was a cross sectional study. Assuming unknown prevalence of hypertensive retinopathy a sample size of 384 (precision of 5% with 95% of confidence level) was calculated. On an average about 30 patients used to come to Hypertension and Research Center, Rangpur daily. From the daily visited patients every 5th patient was taken to generate sample of 384. The first patient was taken by random sampling from 1st to 10th patient. The study was explained to all the patients and written informed consent was taken. After initial

evaluation (duration of hyperetnsion, antihypertensive drug use, dietary and lifestyle modification, follow up interval were commonly asked) blood pressure measurement, systemic examination and direct ophthalmoscopic examination was done in every patient by one of the co-author. Before starting the study, ophthalmoscopic examtion was done in 20 patients and the findings of the patients were varified by an ophthalmologist. All the ophthalmoscopic examtion was done under the supervision of the ophthalmologist. Hypertensive retinopathy was classified according to Keith Wagener Barker (KWB) Grades. The end point of this study was data collection of 384 patients.

### Statistical analysis

The interested variables were processed, edited and analyzed by SPSS windows version 17.0. The socio-demographic data of the study

population were expressed in frequency distribution and their observed difference was tested by one sample's test and 'chi square' test. P value<0.05 was considered as statistically significant with the 95% confidence interval (Table 2). Following are the operational definitions

### Hypertension

Systolic blood pressure  $\geq 140$  mmHg and/or diastolic blood pressure  $\geq 90$  mmHg (or taking antihypertensive medications) in adults 18 years of age or older.

Classification of hypertensive retinopathy, (Table 1) According to Keith Wagener Barker (KWB) Grades

Grading	Findings
Grade 1	Generalized arteriolar constriction - seen as 'silver wiring' and vascular tortuosities
Grade 2	As grade 1 + irregularly located, tight constrictions - Known as '(AV) nicking' or 'AV nipping'
Grade 3	As grade 2 + with cotton wool spots and flame-hemorrhages
Grade 4	As above but with swelling of the optic disk (papilledema)

**Table 1:** Keith Wagener Barker (KWB) grades.

### Data collection

Data was collected from the study population through direct interview and secondary data were taken from their registration book and records. After data collection, data sorting was done, partially filled up data sheet were excluded from the study. Finally we have 313 data sheet for analysis.

### Results

Out of 313 hypertensive patients male were found preponderance (66.1% vs. 33.9%). Mean age of the study population was 51.80 years.

Variables	Frequency	Percentage (%)
<b>Age</b>		
Mean age (SD)		
51.80 years (SD $\pm$ 11.92)		
Age range	18-90 years	
<b>Sex</b>		
Male	207	66.10%
Female	106	33.90%
<b>Occupation</b>		
Housewife	100	31.90%
Agriculture	67	21.40%
<b>Business</b>		
Service	44	14.10%

Retired	73	23.30%
Unemployed	25	8%
Others	1	0.30%
	3	1%
<b>Monthly income</b>		
<5000 taka*	165	52.70%
5001-10000 taka	53	16.90%
10001-15000 taka	44	14.10%
>15000 taka	51	16.30%
Note: *1 dollar = 82 taka		

**Table 2:** Socio-demographic characteristics of the study people at baseline (n=313).

7% (22) patients were smoker at the time of diagnosis of hypertension. But at present 1.3% (1) patient quite smoking, 1.6% (5) patient continued smoking and rest of the patients smoke occasionally.

In our study 29.4% (92) patients had hypertensive retinopathy of different grades (Table 3). Majority of the patient had grade 1 hypertensive retinopathy and grade 4 retinopathy was very minimum 0.3% (1). Average time required to develop retinopathy was 6.73 years (minimum 3 month, maximum 30 years).

Category	Frequency	Percentage
Grade 1	46	14.70%
Grade 2	27	8.60%

Grade 3	18	5.80%
Grade 4	1	0.30%

Mean age of the patients with hypertensive retinopathy was 55.10 years. Prevalence of hypertensive retinopathy was more in male than female (64.1% vs. 35.9%) (P value=0.00652239) and in >50 years age than <50 years age (68.48% vs. 31.52%) (P value=0.0004779) (Table 4).

**Table 3:** Showing different grades of hypertensive retinopathy (n=92).

Age group	Male			Female			Total		
	Screened	Retinopathy	Prevalence	Screened	Retinopathy	Prevalence	Screened	Retinopathy	Prevalence
18-29	5	1	20%	2	1	50%	7	2	28.57%
30-39	35	2	5.71%	12	1	8.33%	47	3	6.38%
40-49	44	10	22.72%	33	9	27.27%	77	19	24.7%
50-59	60	20	33.34%	33	13	39.40%	93	33	35.48%
≥60	63	25	39.68%	26	10	38.46%	89	35	39.32%
Total	207	58	28.01%	106	34	32.07%	313	92	29.40%

**Table 4:** Showing prevalence of hypertensive retinopathy in both sex and different age group (n=92).

Prevalence of hypertensive retinopathy was higher in those with duration of hypertension more than 5 years than those with less than 5 years (34.56% vs. 23.84%) (P value=0.00000251) (Table 5).

Duration of hypertension	Screened	Hypertensive retinopathy	Prevalence
0 - <5 years	151	36	23.84%
5 - <10 years	81	25	30.86%
>10 years	81	31	38.27%

**Table 5:** Shows relation of duration of hypertension with hypertensive retinopathy.

Target organ damage (IHD, stroke and CKD) was more in those with retinopathy than without retinopathy patients (21.73% vs. 19.90%) (Table 6).

TOD	Percentages
IHD	10.86% (10)
Stroke	8.69% (8)
CKD	9.78% (9)

**Table 6:** Target organ damage among the patients with retinopathy.

Mean blood pressure of the hypertensive patient was 141.91/88.02 mm of Hg and blood pressure was controlled in 54%. Prevalence of hypertensive retinopathy in controlled hypertensive was 31.36% and in uncontrolled hypertensive was 27.03% (Table 7).

Variable	Without retinopathy	With retinopathy
Age (years) Mean	50.42 years	55.10 years
Sex (M:F)	67%: 33%	64.1% : 35.9%

Current smoking	1.8%	1.1%
SLT	2.3%	1.1%
Physical inactivity	3.6%	2.2%
Regular exercise (30 minutes walking)	11.8%	4.3%
Sedentary lifestyle	1.4%	2.2%
BMI	42.1%	23.9%
Overweight (25 - 29.9 kg/m <sup>2</sup> )	7.7%	5.4%
Obese (≥ 30 kg/m <sup>2</sup> )		
Uncontrolled blood pressure	47.5%	42.4%
Duration of hypertension	5.46 years	6.73 years
Complications of hypertension	19.90%	25%

**Table 7:** Comparison of hypertensive retinopathy with, without retinopathy.

In our study combined ARB and diuretics was the maximum used antihypertensive drugs (22.4%) followed by ARB alone (22%) (Drug history includes all the drugs taken by the patient along the whole duration of hypertension). Among the different antihypertensive users, prevalence of hypertensive retinopathy was higher among those used ARB + BB (Table 8).

Name of the drugs	Percentage/frequency	Prevalence of hypertensive retinopathy
ARB	22.04% (69)	24.63%
ACEi	1.59% (5)	00
BB	6.70% (21)	23.80%
CCB	4.47% (14)	35.71%
Diuretic	0.95% (3)	33.33%

ARB + BB	4.15% (13)	69.23%
ARB + BB + CCB	3.83% (12)	41.66%
ARB + BB + CCB + Diuretic	1.59% (5)	20%
BB + CCB	9.58% (30)	20%
CCB + D	0.31% (1)	00%
ARB + CCB	12.77% (40)	35%
ARB + Diuretic	22.36% (70)	30%
ARB + BB + Diuretic	1.59% (5)	00%
ARB + CCB + Diuretic	3.19% (10)	20%

**Table 8:** Showing the antihypertensive drug used by the patients and prevalence of hypertensive retinopathy.

## Discussion

In our study we have found prevalence of hypertensive retinopathy was 29.9%. Other studies [10,11] also found similar prevalence of hypertensive retinopathy (30.6% to 33.9%). In a study performed in 2001 on 800 hypertensive patients, the prevalence of grade 1 and grade 2 retinopathies among hypertensive patients was 46% and 32%, respectively, and only a few patients (<2%) showed grade 3 and grade 4 abnormalities [12]. In our study we have also found similar result, grade 1 hypertensive retinopathy was maximum (14.7%) and grade 4 hypertensive retinopathy was minimum (0.3%). Grading of hypertensive retinopathy has prognostic significance. 70% of the grade 1 hypertensive retinopathy patients survived for 3 years which is only 6% in those with grade 4 retinopathy [13]. Hypertensive persons whose blood pressure was uncontrolled more likely to develop retinopathy than individuals whose blood pressure was controlled with medication [14,15]. But in our study hypertensive retinopathy was higher in controlled blood pressure patients (31.36% vs. 27.03%). This may be due to high control blood pressure in our study, blood pressure was control in 54% of the patients. Though many other studies did not find any relation of hypertensive retinopathy with duration of hypertension, hypertensive retinopathy was higher in those with duration of hypertension more than 5 years.

Hypertensive retinopathy of any grade have moderate accuracy in predicting microalbuminuria and hence can be used as a cost-effective screening tool to predict microalbuminuria especially in a resource-poor setting [16]. In our study, among the patients with retinopathy only 10.86% had IHD, 8.69% had history of stroke and 9.78% patients had CKD. These findings may be due to inadequate assessment of the target organ damage. Yu T, et al. [17] showed that retinopathy is correlated with increased age and existence and severity of hypertension, whereas no correlation was found with hypertension duration. In our study we have found that male sex, increasing age (>60 years) and longer duration of hypertension (>5 years) were correlated with hypertensive retinopathy. Combined ARB and thiazide diuretic was the maximum used antihypertensive drug (22.36%), followed by ARB alone (22.04%). Though hypertensive retinopathy was high (69.23%) among those who used ARB and beta blocker combination, this result is not the true reflection, because only 4.15% of the hypertensive patients used ARB and beta blocker combination.

So, relation of the antihypertensive drug and hypertensive retinopathy needs to be examined in later studies with large sample size.

In our study we have used ophthalmoscopic examination to determine and classification of hypertensive retinopathy. Ophthalmoscopic examination has been shown to be unreliable, with high rates of interobserver (20%–40%) and intraobserver (10%–33%) variabilities [18]. Helvacı MR et al. [19] proposed that ophthalmoscopic examination has limited benefit in the management of hypertension due to very low prevalence of grade 3 and grade 4 hypertensive retinopathies, the multifactorial backgrounds of grade 1 and grade 2 hypertensive retinopathies and the association of the multiple risk factors of atherosclerosis in a majority of hypertensive cases. Evaluation of hypertensive retinopathy findings in terms of other cardiovascular risks was supported by previous directives of international hypertension management, including JNC7 and British Hypertension Society [20,21]. These directives underlined that hypertensive retinopathy can be evaluated as an indicator for the target organ damage along with left ventricular hypertrophy and chronic renal failure and suggested that physicians should adopt a more aggressive approach in the management of these patients [21].

## Conclusion

In our study more than one fourth of the hypertensive patients had hypertensive retinopathy. Male sex, increasing age (>60 years) and longer duration of hypertension (>5 years) were positively correlated with hypertensive retinopathy.

## Limitation

Beside Retinopathy other Target organ damage and its co-relation with TOD were not assessed.

## Future Direction

Comparison of ophthalmoscope, fundal photograph and retinal angiography in detection of hypertensive retinopathy and its correlation with target organ damage can be studied.

## Conflict of Interest

There was no conflict of interest.

## Acknowledgement

The authors of this study are grateful to Professor M. A. Jalil Chowdhury, Professor Dr. Md. Mujibur Rahman, staff of Hypertension and Research Centre, Rangpur; Department of Medicine, RpmCH, Department of Medicine of Rangpur Community Medical College.

## Contributions by the Authors

Dr. Ratindra Nath Mondal planned and supervised the study. Dr. Md. Abdul Matin analysed Data. Dr. Moni Rani helped to collect the data. Professor Dr. Md. Zakir Hossain, Professor Dr. Amaresh Chandra Shaha, Professor Ram B. Singh, Dr. Md. Foyjul Islam, Dr. Anupom Das helped in writing of the manuscript and presentation of the data.

## References

1. Kearney PM, Whelton M, Reynolds K, Muntner P, Whelton PK, et al. (2005) Global burden of hypertension: analysis of worldwide data. *Lancet* 365: 217-223.
2. [http://www.who.int/chp/steps/2010\\_STEPS\\_Report\\_Bangladesh.pdf](http://www.who.int/chp/steps/2010_STEPS_Report_Bangladesh.pdf)
3. Rodgers A, Lawes C, MacMahon S (2000) Reducing the global burden of blood pressure related cardiovascular disease. *J Hypertens* 18: S3-6.
4. Mondal RN, Haque MA, Jahan SMS, Azad AK, Rahman MM, et al. (2014) Validity of verbal autopsy questionnaire for assessment of causes of death among patients with hypertension in Bangladesh. *World Heart Journal* 6: 107-116.
5. Lloyd-Jones D, Adams RJ, Brown TM, Carnethon M, Dai S, et al. (2010) Heart disease and stroke statistics: 2010 update: A report from the American Heart Association. *Circulation* 121: e46-e215.
6. Pache M, Kube T, Wolf S, Kutschbach P (2002) Do angiographic data support a detailed classification of hypertensive fundus changes? *J Hum Hypertension* 16: 405-410.
7. Cuspidi C, Salerno M, Salerno DE, Meani S, Valerio C, et al. (2004) High prevalence of retinal vascular changes in never-treated essential hypertensive: an Inter and intra-observer reproducibility study with non-mydratric retinography. *Blood Press* 13: 25-30.
8. Sapira JD (1984) An Internist looks at the fundus oculi. *Dis Mon* 30: 1-64.
9. Duncan BB, Wong TU, Tyroler HA, Davis CE, Fuchs FD (2002) Hypertensive retinopathy and incident coronary heart disease in high-risk men. *Br J Ophthalmol* 86: 1002-1006.
10. Shantha GP, Srinivasan Y, Kumar AA, Salim S, Prabakhar S, et al. (2010) Can retinal changes predict coronary artery disease in elderly hypertensive patients presenting with angina? *Am J Emerg Med* 28: 617-621.
11. Besharati MR, Rastegar A, Shoja MR, Maybodi ME (2006) Prevalence of retinopathy in hypertensive patients. *Saudi Med J* 27: 1725-1728.
12. Cuspidi C, Macca G, Sampieri L, Michev I, Salerno M, et al. (2001) High prevalence of cardiac and extracardiac target organ damage in refractory hypertension. *J Hypertens* 19: 2063-2070.
13. Keith NM, Wagener HP, Barker NW (1974) Some different types of essential hypertension: their course and prognosis. *Am J Med Sci* 268:332-343.
14. Klein R, Klein BE, Moss SE (1997) The relation of systemic hypertension to changes in the retinal vasculature: The Beaver Dam Eye Study. *Trans Am Ophthalmol Soc* 95:329-350.
15. Klein R, Klein BE, Moss SE, Wang Q (1994) Hypertension and retinopathy, arteriolar narrowing and arteriovenous nicking in a population. *Arch Ophthalmol* 112: 92-98.
16. Shantha GP, Kumar AA, Bhaskar E, Sivagnanam K, Srinivasan D, et al. (2010) Hypertensive retinal changes, a screening tool to predict microalbuminuria in hypertensive patients: a cross-sectional study. *Nephrol Dial Transplant* 25: 1839 -1845
17. Mitchell P, Berry G, Li W, Wang JJ (1998) Retinopathy in older persons without diabetes and its relationship to hypertension. *Arch Ophthalmol* 116: 83-89.
18. Dimmitt SB, West JN, Eames SM, Gibson JM, Gosling P, et al. (1989) Usefulness of ophthalmoscopy in mild to moderate hypertension. *Lancet* 1: 1103-1106.
19. Helvacı MR, Ozcura F, Kaya H, Yalcin A (2007) Fundoscopic examination has limited benefit for management of hypertension. *Int Heart J* 48: 187-194.
20. Williams B, Poulter NR, Brown MJ, Davis M, McInnes GT, et al. (2004) British Hypertension Society guidelines for hypertension management 2004 (BHSIV): summary. *BMJ* 328: 634-640.
21. Chobanian AV, Bakris GL, Black HR, Black HR, Cushman WC, et al (2003) The seventh report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure: the JNC7 report. *JAMA* 289: 2560-2572.