International Journal of Advances in Medicine
Rukmini RM et al. Int J Adv Med. 2018 Oct;5(5):1227-1233
http://www.ijmedicine.com
pISSN 2349-3925 | eISSN 2349-3933
DOI: http://dx.doi.org/10.18203/2349-3933.ijam20183899

Original Research Article

Study of essential hypertension with special reference to end organ damage in adults

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Received: 30 June 2018
Revised: 10 July 2018
Accepted: 27 July 2018

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ABSTRACT

Background: Hypertension, a major public health concern, affecting 20-25% of the adult population. It is the major risk factor for diseases involving Cardio Vascular (CV) and renal
system. The World Health Organization (WHO) has estimated that high Blood Pressure (BP) causes 1 in every 8 deaths, making hypertension the third leading killer in the world. The recent emerging trend in the treatment of hypertension is not only based on the pragmatic need to lower BP levels, but also on lowering the CV risk profile, which is largely linked to the presence of the end organ damage.
Methods: One hundred patients with hypertension are recruited in this study. The ethics committee of Rangaraya Medical College, Kakinada approved this study and all the participants provided informed consent for all the procedures in the study protocol.
Results: Majority of the patients (40%) with EOD have hypertension of >10 years duration. The relative frequency of various end organ damages (CVS: 34%, CNS: 17%, kidney: 12% and eye: 10%) is also high in patients with hypertension of >10 years duration.
Conclusions: A significant proportion of hypertensive subjects had documented associated EOD, with LVH being the most prevalent EOD. The above findings emphasize the important role of the primary care clinicians to the early detection, treatment and control of high blood pressure that might help to reducing overall cardiovascular risk.

Keywords: Essential hypertension, End organ damage, Risk factors

INTRODUCTION

Hypertension, a major public health concern, affecting 20-25% of the adult population.[1] It is the major risk factor for diseases involving Cardio Vascular (CV) and renal system.[2] The World Health Organization (WHO) has estimated that high Blood Pressure (BP) causes 1 in every 8 deaths, making hypertension the third leading killer in the world. Globally, there are one billion hypertensive patients and 4 million people die annually as a direct result of hypertension.[1] The number of adult hypertensive patients are predicted to increase from 972 million in year 2000 to 1.56 billion in year 2025.[2] With increase in modified lifestyle (such as smoking, high fat diet, stress and physical inactivity), the prevalence of hypertension has become more prominent. Various studies have shown a significant and continuous relationship between high BP levels and increased risk of end organ damage in terms of CV mortality, Myocardial Infarction (MI), stroke and vascular disease.[1] Elevated Systolic Blood Pressure (SBP) and Diastolic Blood Pressure (DBP) are associated with number of risks including the mortality risk, which is doubled for every 20/10 mmHg increase in SBP/DBP level from the level of 115/75mmHg.[2] There is strong evidence that patients with End Organ Damage (EOD) associated with hypertension have a higher

morbidity and mortality, which can be reduced by accurate evaluation and management of hypertension.[3] The recent emerging trend in the treatment of hypertension is not only based on the pragmatic need to lower BP levels, but also on lowering the CV risk profile, which is largely linked to the presence of the end organ damage.[1]

Hence this study is intended to study prevalence of various patient characteristics like age, sex, Body Mass Index (BMI), smoking, alcoholism, stage and duration of hypertension and their relation to the end organ damage profile in local population.

METHODS

Present study is descriptive cross-sectional study conducted in the department of Medicine, Government General Hospital, Kakinada from November 2015 to August 2017.

Inclusion criteria

- Patients above the age of 40 years with hypertension as per JNC 7 attending outpatient and inpatient facilities in department of Medicine are eligible for enrolment
- Only the patients with essential hypertension are enrolled.

Exclusion criteria

- Patients younger than 40 years
- Patients with secondary hypertension.

One hundred patients with hypertension are recruited in this study. The ethics committee of Rangaraya Medical College, Kakinada approved this study and all the participants provided informed consent for all the procedures in the study protocol. Detailed history is taken, and thorough clinical examination is done for all patients recruited to the study.

Measurement of blood pressure (BP)

BP measurement of right upper arm is done with standard mercury sphygmomanometer with appropriate cuff sizes i.e. width of the bladder of the cuff is equal to at least 40% of arm circumference and the length of the cuff bladder is enough to encircle at least 80% of the arm circumference. After the patient has rested for five minutes and ensuring that he/she had not smoked or taken coffee within 30 minutes of measuring the BP, SBP is taken as the first of at least two regular tapping Korotkoff sounds and DBP as the point at which last regular Korotkoff sounds is heard. Two BP readings are taken at intervals of 2 minutes and the average reading is calculated. According to JNC 7, hypertension is classified into stage 1 if SBP is 140-159mmHg or DBP is 90-99mmHg and stage 2 if SBP is >160mmHg or DBP is >100mmHg.

Hemoglobin (Hb), fasting blood sugar (FBS), lipid profile, blood urea nitrogen (BUN), serum creatinine (S Cr), complete urine examination, 24hr urinary proteins, chest x-ray (CXR) electrocardiogram (ECG), USG abdomen, and fundoscopy are done for all the patients. Echocardiography and CT Brain are done in necessary patients.

All the patients are evaluated with CXR to detect cardiomegaly. ECG is taken to detect Left Ventricular Hypertrophy (LVH) according to Sokolow-Lyon voltage criteria (SV1+RV5> 3.5mV, R aVL> 1.1mV) and Cornell voltage criteria (SV3 + R aVL $\geq$ 2.8mV (for men), SV3 + R aVL>2.0mV (for women)), ischemic heart disease (IHD) with Q waves and ST-T changes, atrial fibrillation (AF) with varying R-R interval and absence of p waves. Those having abnormal ECG are further evaluated with 2D-Echocardiography.

Patients presenting with symptoms of raised intracranial tension and focal neurological deficits are evaluated with CT (computed tomography) brain to detect infarcts, intra cerebral hemorrhage (ICH), sub-arachnoid hemorrhage (SAH) and hypertensive encephalopathy.

Chronic kidney diseases are defined as persistent proteinuria in the absence of urinary tract infection or impaired glomerular filtration rate (60 ml/min/1.73m^2) according to Cockcroft-Gault equation.

Creatinine Clearance [Cr Cl] (ml/min) =

$$\frac{\text{(140- age) X body weight (kg)}}{\text{72 X plasma creatinine (mg/dl)}}$$

(multiply with 0.85 for women)

Fundus is examined using direct ophtholmoscope and retinopathy is classified into 4 grades according Keith Wegener and Barker classification. Grade 3 and 4 retinopathy are used as evidence of EOD in the eyes.

End organ damage (EOD) is studied in relation to age, sex, life style pattern, smoking, alcoholism, high salt diet, BMI, stage and duration of hypertension and compliance to treatment and significance of their association with EOD is analyzed.

Statistical analysis

All statistical analyses are performed using the SPSS 19.0 for Windows platform. Data is summarized using descriptive statistics. Chi square test is used to analyze group difference. For all statistical tests of significance, the values are two tailed and unless.

RESULTS

In present study of 100 hypertensive patients 63 are men and 37 are women. In the present study majority of the patients (34%) are in the age group of 60-69 years. Fifty eight percent of the patients are above the age of 60 years. Mean age of the patients studied is 61.9 (±8.7). Out of 100 patients 52 (47 men and 5 women) have active life style and 48 (16 men and 32 women) have sedentary life style.

Table 1: Baseline character of the patients.

Variables	Groups	Male	Female	Total (%)
Age (yrs)	40-49 yrs	10	6	16 (16%)
	50-59 yrs	18	8	26 (26%)
	60-69 yrs	23	11	34 (34%)
	≥70 yrs	12	12	24 (24%)
	Total	63	37	100
Life style	Active	47	5	52 (52%)
	Sedentary	16	32	48 (48%)
BMI	Normal	40	17	57 (57%)
	Over weight	17	12	29 (29%)
	Obese	6	8	14 (14%)
Duration	0-5 yrs	12	10	22 (22%)
	6-10 yrs	26	10	36 (36%)
	>10 yrs	25	17	42 (42%)
	Mean duration	9.2 (±3.5)	9.6 (±4.1)	9.38 (±3.7)
Stages	Stage I	32	24	56 (56%)
	Stage II	31	13	44 (44%)
Compliance treatment	Compliant	31	18	49 (49%)
	Non-compliant	32	19	51 (51%)
End organ damage (EOD)	Present	44	23	67 (67%)
	Absent	19	14	33 (33%)

Out of 100 patients, 57 (40 men and 17 women) have normal BMI. Twenty nine (17 men and 12 women) patients are overweight and 14 (6 men and 8 women) are obese.

Table 2: Clinical features.

Clinical features	Frequency (%)
Asymptomatic	38 (38%)
Headache	33 (33%)
Weakness of limbs	19 (19%)
Breathlessness	16 (16%)
Swelling of feet	14 (14%)
Chest pain	12 (12%)
Palpitations	7 (7%)

Studied patient population has duration of hypertension ranging from 3-16 years with mean duration of 9.38 (±3.7) years. Many of the patients (42%) in the present study have hypertension of >10 years. Mean SBP of the patients is 161.8 (±23.3) mmHg and DBP is 98 (±10.4) mmHg. Hypertension is graded as stage 1 (SBP is 140-159mmHg or DBP is 90-99mmHg) and stage 2 (SBP is >160mmHg or DBP is >100mmHg) as per the guidelines of JNC 7. In the present study 56% patients belong to stage 1 hypertension and 44% of the patients belong to stage 2 hypertension.

Out of 100 patients 49 patients (31 men and 18 women) are compliant to treatment and 51 (32 men and 19 women) are non-compliant. Out of 100 patients studied 67 (44 men and 23 women) patients are having end organ damage due to hypertension. Thirty three patients (19 men and 14 women) do not have any end organ damage.

Table 3: Prevalence of risk factors.

Risk Factors	Men	Women	Total (%)
Family H/O hypertension	25	14	39 (39%)
Smoking	34	4	38 (38%)
Alcoholism	28	0	28 (28%)
High salt diet	25	14	39 (39%)
Diabetes mellitus	11	5	16 (16%)
Dyslipidemia	11	12	23 (23%)

Out of 100 patients 38 patients are asymptomatic. Most common symptom is headache in 33 patients followed by weakness of limbs, breathlessness, swelling of feet, chest pain and palpitations.

Table 4: Categories of end organ damage.

EOD	Men	Women	Total (%)
CVS	34	19	53 (53%)
CNS	21	3	24 (24%)
Renal	8	9	17 (17%)
Eye	9	1	10 (10%)
Single EOD	23	15	38 (38%)
Multiple EOD	21	8	29 (29%)

The most common risk factors observed in the present study are positive family history of hypertension (39%), consumption of high salt diet (39%) and smoking (38%). Other risk factors include alcoholism (28%), diabetes mellitus (16%) and dyslipidemia (23%).

Table 5: Categories of cardio vascular involvement.

Category	Men	Women	Total (%)
LVH	16	8	24 (24%)
HF	12	7	19 (19%)
IHD	8	7	15 (15%)
AF	3	3	6 (6%)

Cardiovascular system is the most commonly affected end organ in 53% of the patients followed by CNS (24%), renal (17%) and eye (10%). Thirty eight (23 men and 15 women) patients have single EOD and 29 patients

(21 men and 8 women) have multiple EOD. Out of 100 patients various categories of CVS involvement are LVH in 24 %, heart failure in 19%, IHD in 15% and AF in 6%.

Table 6: Categories of CNS involvement.

Category	Men	Women	Total (%)
Ischemic stroke	13	3	16 (16%)
Hemorrhagic stroke (ICH+SAH)	6	0	6 (6%)
Hypertensive encephalopathy	2	0	2 (2%)

Out of 67 patients with EOD, 24 patients (36%) have stage 1 hypertension and 43 patients (64%) have stage 2 hypertension.

Out of 38 patients with single organ damage, 17 patients (45%) have stage 1 hypertension and 21 patients (55%) have stage 2 hypertension. Similarly, out of 29 patients with EOD, 7 patients (24%) have stage 1 hypertension and 22 patients (76%) have stage 2 hypertension.

It is observed in the present study that stage 2 hypertension is more commonly associated with damage of various end organs like CVS in 39 of 53 (73.5%), CNS in 15 of 24 (62.5%), kidney in 10 of 17 (58%) and eye in 8 of 10 (80%) patients than stage 1 hypertension.

Majority of the patients (40%) with EOD have hypertension of >10 years duration. The relative frequency of various end organ damages (CVS: 34%, CNS: 17%, kidney: 12% and eye: 10%) is also high in patients with hypertension of >10 years duration.

Table 7: Stage of hypertension and EOD.

EOD	Stage 1 (%)	Stage 2 (%)	Total
CVS	14 (26.5)	39 (73.5)	53
CNS	9 (37.5)	15 (62.5)	24
Kidney	7 (42)	10 (58)	17
Eye	2 (20)	8 (80)	10
Single EOD	17 (45)	21 (55)	38
Multiple EOD	7 (24)	22 (76)	29
Total	24 (36)	43 (64)	67

Table 8: Duration of hypertension and EOD.

EOD	0-5 yrs (%)	6-10 yrs (%)	>10 yrs (%)	Total
CVS	5 (5)	14 (14)	34 (34)	53
CNS	0	7 (7)	17 (17)	24
Kidney	0	5(5)	12 (12)	17
Eye	0	0	10 (10)	10
Single EOD	5 (5)	18 (18)	15 (15)	38
Multiple EOD	0	4(4)	25 (25)	29
Total	5 (5)	22(22)	40 (40)	67

Risk factors for end organ damage

Twenty three of 42 (54%) patients with age group 40-59 years have EOD, whereas 44 of 58 (76%) patients older than60 years have EOD. This finding is statistically significant (p=0.027). Hence age is a risk factor for EOD in hypertensives.

Forty four of 63 (69%) men and 23 of 37 (62%) women have EOD. This finding is statistically insignificant (p=0.43). Hence gender is not a risk factor for EOD in hypertensives. Thirty three of 52 (63%) patients with active life style and 34 of 48 (70%) with sedentary life style are having EOD. This is statistically insignificant (p=0.433). Hence life style is not a risk factor for EOD in present study. Thirty two of 39 (82%) patients consuming high salt diet have EOD whereas 35 of 61 (57%) patients consuming normal diet have EOD. This relation is statistically significant (p=0.01). Hence high salt diet is a risk factor for EOD in hypertensives. Twenty six of 38 (68%) smokers have EOD and 41 of 62 (66%) non-smokers have EOD.

Table 9: Association between risk factor and end organ damage.

Variables		EOD	NO EOD	Total	P value
Age (yrs)	40-59 yrs	23	19	42	0.027
	>60 yrs	44	14	58	
Sex	Male	44	19	63	0.43
	Female	23	14	37	
Life style	Sedentary	33	19	52	0.433
	Active	34	14	48	
Diet	High salt	32	7	39	0.01
	Normal salt	35	26	61	
Smoking	Non-smoker	41	21	62	0.81
	Smoker	26	12	38	
Alcohol	Alcoholic	24	4	28	0.013
	Non-alcoholic	43	29	72	
BMI	Normal	37	20	57	0.86
	Over weight	20	9	29	
	Obese	10	4	14	
Stages of hypertension	Stage I	24	32	56	0.0001
	Stage II	43	1	44	
Duration	0-5 yrs	5	17	22	0.0001
	5-10 yrs	22	14	36	
	>10 yrs	40	2	42	
Compliance to treatment	Compliant	23	26	49	0.001
	Non-compliant	44	7	51	

This relation statistically not significant (p=0.81). Hence in present study smoking is not a risk factor for EOD. Twenty four of 28 (86%) alcoholics have EOD whereas 43 of 72 (60%) non-alcoholics have EOD. This relation is statistically significant (p=0.013).

Hence alcohol consumption is a risk factor for EOD in hypertensives. Thirty seven of 57(65%), 20 of 29 (69%) and 10 of 14 (71%) patients with normal BMI, overweight and obesity respectively have end organ damage. This relation is statistically insignificant (p= 0.86). Hence BMI is not a risk factor for EOD. Twenty four of 56(43%) stage 1 hypertensives have EOD whereas 43 of 44(97%) stage 2 hypertensives have EOD. This relation is statistically significant (p= 0.0001). Hence stage of hypertension is a risk factor for EOD.

Five of 22 (23%), 22 0f 36 (61%), 40 of 42 (90%) patients with hypertension duration more than 5 years, 6-10 years and >10 years respectively have EOD. This relation is statistically significant (p= 0.0001). Hence duration of hypertension is a risk factor for EOD. Twenty three of 49 (47%) patients compliant to treatment have EOD whereas 44 of 51(86%) non-compliant patients have EOD. This relation is statistically significant (p=0.0001). Hence non-compliance to treatment is a risk factor for EOD.

DISCUSSION

Hypertension is often asymptomatic and by the time of diagnosis some patients would have developed target organ damage due to low levels of detection, treatment and control. The proportion of hypertension was found to steadily increase with age, being highest in the 60-69 years age group (34%) in present study. Majority of patients with HTN (58%) are above 60 years in the present study. Similar results of higher prevalence of hypertension in older age groups were reported by Chennai urban population study (54% in >60 years), Jaipur urban study (58% in >50 years) and Delhi urban study (28.1% in > 55 years).[4-6]

In present study group males (63%) are more than females (37%) with ratio of 1.7:1. Similar results were published in a study by Reddy et al, and Kulkarni et al, (1.3:1).[7,8] The large difference in the sex ratio in present study may be due to the fact that the percentage of males coming as in-patients or out patients in any general hospital is 4 to 5 times higher than that of the female patients.

In present study 38% of hypertensives were asymptomatic. Proportion of asymptomatic females was more than males. Similar results were reported by Kulkarni et al.[8]

Most common symptom in present study was headache (32%). Similarly, Chowta et al, reported headache as most common symptom (36%) in their study.[9] Kulkarni et al, reported that 77.9% patients in their study had headache as the chief complaint.[8]

A positive family history is an important risk factor for hypertension. In present study 39% patients had family history of hypertension. In hypertension genetic distribution has been estimated in the range from 30-60%.[8] Similarly Reddy et al, reported positive family history in 23.3% of their population.[7] In contrast in a national study sponsored by Cardiological Society of India (CSI), 74% had family history of hypertension.[10]

Thirty eight percent of studied patients were smokers. Anand et al, in a national study of smoking and hypertension of 918 hypertensives from 93 urban centres from all over India.[10] Malhotra et al, reported that 28% were smokers In CSI study of 277 hypertensives, 24.5% of hypertensives were smokers.[11] Reddy et al, reported 22.4% prevalence of smoking in their hypertensive population.[7] In present study 28% were alcoholics. Similarly, Kulkarni et al, reported 25% and Reddy et al, reported 20% alcoholics in their respective studies.[7,8]

In present study 43% patients had body mass index (BMI) >25. Similarly, the Jaipur urban (both sexes) and rural studies (only males), Haryana (Chandigarh) rural study, the Chennai urban population study as well as the Bombay executive study have all shown a higher weight and BMI amongst hypertensive groups. In the Bombay executive study.[4,5,10,12]

Around 70.3% of grade II and grade III hypertensives had a BMI ≥25 compared to 47.2% of normotensives and 36.4% of those with optimal blood pressure, (unpublished results). In contrast Reddy et al, reported prevalence of BMI >25 in only 14.9% of their study population.[7]

In present study diabetics were 16%. Prevalence of diabetes was 33.3% in a study by Reddy et al, and 25.5% in a study by Shantirani et al.[4,7]

Twenty three percent patients in present study had dyslipidemia. In contrast, Kulkarni et al, reported 55.9% prevalence of dyslipidemia in their Bombay study.[8] This difference could be due to urban and rural population differences. Qi et al, from mainland China reported similar, 24.5% prevalence of dyslipidemia in their study population.[13] Sixty seven percent patients in present study had end organ damage (EOD). Similar high prevalence of EOD was reported by Ayodele et al, (60.1% and 66.7%in different populations in Nigeria).[14,15] Addo et al, reported 47.5% EOD in Ghanaian civil servant population in UK and Oladapo et al, reported 43.1% EOD in Nigerian yoruba adult population.[16,17]

Among the end organ involvement, cardiovascular system (CVS) was the most commonly affected system (53%) in present study. Similarly, CVS was most commonly involved in studies done by Njoh et al, in adult urban Liberians (55.2%) and Dwivedi et al, in Delhi, India.[18,19] Left ventricular hypertrophy (LVH) was the most common EOD in present study (24%). Similarly, LVH was most common EOD in studies done by Kulkarni et al, (36.8%), Bertomeu et al, (25.1%), Oladapo et al, (43.1%) in Nigerian Yoruba adult population, Addo et al, (33.3%) in Ghanaian civil servant

population in UK and Ayodele et al, (42.2%) in Nigeria.[8,14,16,17,20] In contrast Dwivedi et al, reported ischemic heart disease (IHD) as most common CVS damage (57.05%) and LVH was only 12.8% in their study.[19] The prevalence of IHD was 15%, heart failure (HF) was19% and atrial fibrillation (AF) was 6% in present study. Oladapo et al, reported similar prevalence of IHD (12%) in their study.[17] Ayodele et al, reported 10.8% prevalence of HF in their Nigerian study.[14]

Central nervous system (CNS) was second most common system involved in present study with 24% prevalence. Dwivedi et al, 19 reported similar prevalence (23.7%) of CNS involvement.[19] Njoh et al, also reported CNS as 2nd most common system involved (31.4%).[18] Cui et al, reported 32.2% and Ayodele et al, reported 8.9% prevalence of stroke in their respective studies.[15,21]

Prevalence of chronic kidney disease was 17% in present study. Similar prevalence was reported by Ayodele et al, (18.2%) and a higher incidence of renal involvement was noted by Cui et al, (27.33%).[15,21] In present study prevalence of hypertensive retinopathy was 10% (Grade III and IV). Similarly, Ayodele et al, reported 7.4% prevalence of advanced retinopathy. Oladapo et al, reported 2.2% and Addo et al, reported 1% prevalence of hypertensive retinopathy.[15-17]

In present study single EOD was seen in 38% and multiple EOD was seen in 29%. Similarly, single EOD in 33% and multiple EOD in 20% patients was reported by Cuspidi et al, from Italy.[22] In contrast Cui et al, reported prevalence of multiple EOD in more patients (47.2%) than single EOD (23.2%).[21] In present study we found that advanced age was a risk factor for EOD (p= 0.027). Similarly, Cui et al, Ayodele et al, Addo et al, and Hussain et al, found that older age was a risk factor for end organ damage in hypertension.[14,16,21,23]

In present study there was no association between gender and EOD (p= 0.43). Similar findings were reported in a Nigerian study by Ayodele et al, in treated hypertensives.[14] In contrast Addo et al, and Ayodele et al, in a study in newly diagnosed hypertensives found male gender as a risk factor for EOD.[14,16]

No relation between life style pattern and EOD was observed in the present study (p=0.433). Observational and experimental studies have revealed the role of physical inactivity and its association with high blood pressure. Regular physical activity facilitates weight loss, decreases blood pressure, and reduces the overall risk of cardiovascular disease. Even though sedentary habit is a risk factor and regular physical activity is advantageous in management of hypertension, we did not come across any studies exploring relation between physical activity and EOD. So, sedentary habit may not be an independent risk factor for EOD. A significant association between high salt diet and EOD was observed in the present study (p=0.01). Ohta et al, found that salt excretion contributed to proteinuria (P <0.05) or left ventricular mass index (LVMI) (P = 0.11) independent of age, sex, serum creatinine, and BP levels and concluded that high salt intake was possibly associated with end organ damage.[24,25]

Similarly, Yilmaz et al, found urinary sodium excretion as an independent predictor of both C-reactive protein (CRP) and albuminuria and concluded that high salt intake was associated with enhanced inflammation and end organ damage in treated hypertensive patients independent of any BP effect.[25] Du Cailar et al, found similar results and given similar conclusion.[26] No significant association between smoking and EOD was observed in present study (p=0.81). Hussain et al, and Kulkarni et al, found smoking as a risk factor for EOD.[8,23] This difference may be because more smokers in present study group are having duration of hypertension <10 years.

As it was found that the duration of hypertension is a risk factor for EOD without adjusting confounding factors like these it is not possible to conclude that smoking may not be a risk factor for EOD.

However, in some studies, prolonged smoking has not been associated even with elevated blood pressure. Malhotra et al, in the Haryana (Chandigarh) rural study also did not found any significant association of smoking with hypertension in their multivariate analyses.[11] Alcoholism was associated with increased prevalence of EOD in present study (p=0.013). Kulkarni et al, found that alcoholism increases the risk of complications by three to four folds and concluded that alcohol as a risk factor for EOD.[8]

In present study, authors found that there was no association between body mass index (BMI) and EOD (p=0.86). In this regard there was a vast diversity in various studies. Similar to present study Ayodele et al, did not find any association between BMI and EOD in a study in treated hypertnsives.[15] Hussain et al, and Cui et al, found association between high BMI and EOD.[21,23] In contrast to above studies Ayodele et al, in a study in newly diagnosed hypertensives found association between low BMI and EOD.[14]

Authors found association between advanced stage of hypertension and EOD (p=0.0001). Similar results were found in studies by Kulkarni et al, Addo et al, Cui et al, Ayodele et al, and Oladapo et al, and concluded that more the severity of BP, more was the risk for EOD.[8,15-17,21]

In present study long duration of hypertension was associated with EOD. Hussain et al, and Cui et al, found similar association between duration of hypertension and EOD.[21,23] Poor compliance to the treatment of hypertension was associated with EOD in present study. Hussain et al, Cui et al, and Addo et al, found similar association between poor control of BP and EOD.[16,21,23]

CONCLUSION

In conclusion a significant proportion of hypertensive subjects had documented associated EOD, with LVH being the most prevalent EOD. The above findings emphasize the important role of the primary care clinicians to the early detection, treatment and control of high blood pressure that might help to reducing overall cardiovascular risk.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Rukmini RM, Rajya LM. Study of essential hypertension with special reference to end organ damage in adults. Int J Adv Med 2018;5:1227-33.