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ORIGINAL RESEARCH

A study to evaluate comparison of hematological Parameters and BMI in hypertensive patients-observational study

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Abstract

Introduction: Hypertension is not the mere determinant of damage of cardiovascular system, and the likelihood of hypertensive patients, with uncontrolled blood pressure, to develop target organ damage is markedly affected by coexisting risk factors. The present study was conducted with the aim to study Body Mass Index and Hematological Parameters in Hypertensive Patients.

Material and methods: The present cross sectional study was carried out among hypertensive patients. Relevant clinical data was recorded in a structured Proforma. Complete hemogram was recorded. Blood pressure was measured by a BP measuring devices. Body mass index was measured by weight in kilograms divided by square of height in meters (kg/m^2). Data will be analysed statistically.

Results: Comparative mean Hb among male was statistically significant (p=0.024) and (p=0.189), nonsignificant among female. Comparative mean RBC count among male was statistically nonsignificant (p=0.437) and (p=0.783) nonsignificant among female. Comparative mean PCV among male was statistically significant (p=0.007) and nonsignificant (p=0.321) among female subjects. Comparative mean MCV among male was (p=0.296) and (p=0.310) among female statistically nonsignificant. Comparative mean RDW among male was statistically nonsignificant (p=0.449) and nonsignificant (p=0.180) among female subjects.

Conclusion: With the rise in the prevalence of overweight and obesity in the younger generation, the prevalence of hypertension has also been reported to have increased significantly. By using simple screening methods in younger ages, like measuring BMI, it is possible to identify individuals at high risk, at an early age. It was found that Hb and PCV increases with an increase in BMI, in hypertensive patients. The values of hematologic and plasma biochemical results as reported can be used by attending clinicians in evaluating health and disease in individuals.

Keywords: BMI; Hematological; Hb; Hypertension

Introduction

Body Mass Index (BMI) and other anthropometric measurements have been reported as significantly correlated with hypertension.[1] Researchers have found that hypertension is common in subjects with both extremely low and high BMI levels.[2] BMI and the waist circumference are considered as an indicator for the prediction of hypertension in men and women respectively.[3]

Hypertension is not the mere determinant of damage of cardiovascular system, and the likelihood of hypertensive patients, with uncontrolled blood pressure, to develop target organ damage is markedly affected by coexisting risk factors. Among them, lipoproteins are heavily implicated in the atherosclerotic process and greatly influence the impact of hypertension on development of target organ injury and hence cardiovascular morbidity and mortality.[4] In addition, there are number of disputes in various studies with respect to variability of hematological parameters in patients with hypertension and normotensive subjects. The pathophysiology of hypertension is multifactorial which is affected by sympathetic overactivity contributing to changes in hematological parameters such as hematocrit, viscosity, and hypercoagulability of blood. These factors vary the kinetics of blood flow acting as contributory risk factor for coronary artery diseases, stroke, and thromboembolism.[5]

The present study was conducted with the aim to study Body Mass Index and Hematological Parameters in Hypertensive Patients.

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Material and methods

The present cross sectional study was carried out at L.N. Medical College & Research centre and associated J.K Hospital Bhopal over a period of 2 years in the Department of Medicine among four hundred patients attending OPD/IPD.

Inclusion criteria comprised of all hypertensive patients with age 18 years and older. Exclusion criteria consisted of patients with hypertension with history of acute/chronic systemic illness or disorder, history of blood transfusion within 3 months and any drug or substance which can alter hematological parameters were excluded.

Subjects fulfilling the inclusion and exclusion criteria were included in the study. Informed consent was obtained from the subjects after explaining the nature of the study. Relevant clinical data was recorded in a structured Proforma. Complete hemogram was recorded.

Blood pressure was measured by a BP measuring devices. Patients were seated quietly for at least 5 minutes in a chair with feet on the floor, arm supported at heart level. Blood pressure will be measured two times. The average of two readings was taken for correct systolic and diastolic blood pressure.[6]

Body mass index was measured by weight in kilograms divided by square of height in meters (kg/m^2).

Data will be analysed statistically. Analysis is going to be done in the form of percentages, proportions and represented as tables, charts, graphs wherever necessary. Appropriate tests of significance are to be applied.

Results

Table 1: Gender wise distribution of study subjects according to BMI grades

	Male		Female		Total	
BMI grades[7]	**Frequency**	**Percentage%**	**Frequency**	**Percentage%**	**Frequency**	**Percentage%**
Underweight (BMI<18.5)	15	7.5	12	6	27	6.75
Normal (BMI 18.5-22.9)	53	26.5	54	27	107	26.75
Overweight (BMI 23-24.9)	35	17.5	30	15	65	16.25
Obese (BMI≥25)	97	48.5	104	52	201	50.25
Chi square value: 0.971			p value:0.80			
BMI						
<23	71	35.3	63	31.7	124	31.0
≥23	130	64.7	136	68.3	236	59.0
	Chi square value: 0.60		p value:0.43			

Table 1 shows gender wise distribution of study subjects according to BMI grades it was revealed that there 15 male and 12 female subjects were underweight, 53 male and 54 female were normal, 35 male and 30 female were overweight and 97 male and 104 female were obese. BMI grading shows 71 male and 63 female had there BMI grade <23 and 130 male and 136 female subjects had BMI ≥23 which was showing nonsignificant (p=0.80) association.

Table 2: Gender wise comparison of mean haematological parameters of study subjects according to BMI grades

		Male		Female	
Parameter (reference value)[86]	**BMI grades**	**Mean**	**Std. Deviation**	**Mean**	**Std. Deviation**
Hb (g/dl) M=12.3-17 F=9.9-14.3	**Underweight**	12.28	1.29	12.74	1.18
	Normal	13.58	1.50	13.52	1.43
	Overweight	13.34	1.65	13.01	1.51
	Obese	13.71	1.69	13.03	1.62
		F value-3.202 **p value-0.024***		**F value-1.609 p value 0.189**	
RBC Count (mill/cumm) M=4.5-5.5 F=3.5-5.2	**Underweight**	4.22	0.40	4.22	0.58
	Normal	4.47	0.51	4.42	0.72
	Overweight	4.50	0.65	4.43	0.65
	Obese	4.47	0.54	4.81	3.89
		F value-0.910 p value-0.437		**F value-0.359 p value-0.783**	
PCV (%)	**Underweight**	34.04	3.00	36.17	3.14

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M=37-51 F=30-43	**Normal**	38.17	4.01	38.13	4.78
	Overweight	37.32	4.64	37.30	4.18
	Obese	38.39	4.54	36.85	4.56
		F value-4.118; p value-0.007*		**F value-1.174; p value-0.321**	
MCV (fl) M=78-97 F=72-96	**Underweight**	83.03	6.03	80.74	11.60
	Normal	85.73	8.66	84.92	6.03
	Overweight	83.12	8.80	84.49	9.45
	Obese	85.68	7.72	82.90	9.07
		F value-1.241;p value-0.296		**F value-1.204 pvalue-0.310**	
MCHC (g/dl) M=31-36 F=30-35	**Underweight**	35.67	1.80	35.39	1.75
	Normal	35.30	1.34	35.64	1.46
	Overweight	35.47	1.38	34.94	1.56
	Obese	35.43	1.79	35.41	1.60
		F value-0.255 p value-0.879		**F value-1.255 pvalue-0.291**	
RDW (%) M-12.23-15.36 F-12.3-15.85	**Underweight**	13.67	1.72	13.19	1.10
	Normal	13.82	1.05	12.93	0.84
	Overweight	14.00	1.36	13.49	1.58
	Obese	13.63	1.13	13.31	1.20
		F value-0.886;p value-0.449		**Fvalue-1.648;pvalue-0.180**	
TLC (/cumm) M=4200-9800 F=4000-10400	**Underweight**	6607.69	2507.14	6535.71	1901.26
	Normal	6567.24	1345.61	6858.78	1617.59
	Overweight	6494.12	1686.48	6738.71	2081.93
	Obese	6604.27	1697.67	6978.00	1825.21
		F value-0.039 p value-0.990		**F value-0.331 p value-0.803**	
Platelet count (Lac/cumm) M=1.3-3.8 F=1.3-4.2	**Underweight**	2.20	0.53	2.69	0.63
	Normal	2.55	0.69	2.41	0.71
	Overweight	2.75	1.14	2.22	0.87
	Obese	2.59	0.79	2.49	0.76
		F value-1.443 p value -0.231		**F value-1.566 p value** -0.199	

*Statistically significant

Table 2 shows gender wise comparison of mean haematological parameters of study subjects according to BMI grades results revealed that mean Hb among underweight male was 12.28 and female was 12.74, among normal BMI mean Hb was 13.58 among male and 13.52 in female, in overweight subjects mean Hb was 13.34 among male and 13.01 among female in obese mean Hb was 13.71 among male and 13.03 among female. Comparative mean Hb among male was statistically significant (p=0.024) and (p=0.189), nonsignificant among female. Mean RBC count among underweight male was 4.22 and female was 4.22, among normal BMI mean RBC count was 4.47 among male and 4.42 in female, in overweight subjects mean RBC count was 4.50 among male and 4.43 among female, in obese mean RBC count was 4.47 among male and 4.81 among female. Comparative mean RBC count among male was statistically nonsignificant (p=0.437) and (p=0.783) nonsignificant among female. Mean PCV among underweight male was 34.04 and female was 36.17, among normal BMI mean PCV was 38.17 among male and 38.13 in female, in overweight subjects mean PCV was 37.32 among male and 37.30 among female, in obese mean PCV was 38.39 among male and 36.85 among female. Comparative mean PCV among male was statistically significant (p=0.007) and nonsignificant (p=0.321) among female subjects. Mean MCV among underweight male was 83.03 and female was 80.74, among normal BMI mean MCV was 85.73 among male and 84.92 in female, in overweight subjects mean MCV was 83.12 among male and 84.49 among female, in obese mean MCV was 85.68 among male and 82.90 among female. Comparative mean MCV among male was (p=0.296) and (p=0.310) among female statistically nonsignificant. Mean MCHC among underweight male was 35.67 and female was 35.39, among normal BMI mean MCHC was 35.30 among male and 35.64 in female, in overweight subjects mean MCHC was 35.47 among male and 34.94 among female in obese mean MCHC was 35.43 among male and 35.41 among female. Comparative mean MCHC among male (p=0.879) and (p=0.291) among female was statistically nonsignificant. Mean RDW among underweight male was 13.67 and female was 13.19, among normal BMI mean RDW was 13.82 among male and 12.93 in female, in overweight subjects mean RDW was 14.00 among male and 13.49 among female, in obese mean RDW was 13.63 among male and 13.31 among female Comparative mean RDW among male was statistically nonsignificant (p=0.449) and nonsignificant (p=0.180) among female subjects. Mean TLC among underweight male was 6607.69 and female was 6535.71, among normal BMI mean TLC was 6567.24 among male and 6858.78 in female, in overweight subjects mean TLC was 6494.12 among male and 6738.71 among female, in obese mean TLC was 6604.27 among male and 6978.00 among female. Comparative mean TLC among male was statistically

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nonsignificant (p=0.990) and nonsignificant (p=0.803) among female subjects. Mean platelet count among underweight male was 2.20 and female was 2.69, among normal individual mean platelet count was 2.55 among male and 2.41 in female, in overweight subjects mean platelet count was 2.75 among male and 2.22 among female, in obese mean platelet count was 2.59 among male and 2.49 among female. Comparative mean platelet count among male was statistically nonsignificant (p=0.231) and nonsignificant (p=0.199) among female subjects.

Discussion

The gender wise comparison of mean hematological parameters of study subjects according to BMI grades results revealed that mean Hb among underweight male was 12.28 and female was 12.74, among normal BMI mean Hb was 13.58 among male and 13.52 in female, in overweight subjects mean Hb was 13.34 among male and 13.01 among female in obese mean Hb was 13.71 among male and 13.03 among female. Comparative mean Hb among male was statistically significant (p=0.024) and non-significant among female (p=0.189). RBC count among both male and female was statistically non-significant (p=0.437) and (p=0.783) non-significant. Mean PCV among underweight male was 34.04 and female was 36.17, among normal BMI mean PCV was 38.17 among male and 38.13 in female, in overweight subjects mean PCV was 37.32 among male and 37.30 among female, in obese mean PCV was 38.39 among male and 36.85 among female. Comparative mean PCV among male was statistically significant (p=0.007) and non-significant (p=0.321) among female subjects. Comparative mean MCV among male was (p=0.296) and (p=0.310) among female statistically non-significant. Comparative mean MCHC among male (p=0.879) and (p=0.291) among female was statistically non-significant. Comparative mean RDW among male was statistically non-significant (p=0.449) and non-significant (p=0.180) among female subjects. Comparative mean TLC among male was statistically non-significant (p=0.990) and non-significant (p=0.803) among female subjects. Comparative mean platelet count among male was statistically non-significant (p=0.231) and non-significant (p=0.199) among female subjects.

Divya R et al[8] performed a study to compare the hematological parameters and anthropometric indicators in hypertensive and normotensive males. The mean levels of hemoglobin and hematocrit were significantly lower in the hypertensive group compared to the normotensives in study. Enawgaw B et al[9] study was to assess some hematological parameters of hypertensive individuals in comparison with normotensive individuals at University of Gondar hospital, northwest Ethiopia. In the present study, the median (IQR) value of WBC, RBC, Hgb, HCT, MCV and the mean value of MCHC, RDW, MPV and PDW were significantly higher in hypertensive group compared to apparently healthy normotensive groups. Additionally, WBC, RBC, Hgb, HCT and PLT showed statistically significant positive correlations with blood pressure indices. Platelet count and MCH did not show statistically significant difference between the two groups. Emamian M et al[10] explored a total of 9808 individuals were enrolled. Hematological parameters including white blood cell count, red blood cell count, hemoglobin, hematocrit, and mean corpuscular haemoglobin were higher in the hypertensive group compared to the control group. But mean corpuscular volume, and red cell distribution width, were decreased in the hypertensive group. Furthermore, results strongly suggested that among these parameters, hematocrit was the independent risk factor for hypertension in the population. Gebrie A et al[11] was to evaluate lipid profiles and hematological parameters in hypertensive patients at Debre Markos Referral Hospital, Northwest Ethiopia. Laboratory-based cross-sectional study was conducted in 100 eligible hypertensive patients at the hospital. Higher levels of low-density lipoprotein, hemoglobin, and red blood cell count were observed in the hypertensive patients whose blood pressure had been poorly controlled than the controlled ones ($p < 0.05$). Waist circumference had a significant positive association with the serum levels of total cholesterol and white blood cell count ($p < 0.05$). Kumar A et al[6] performed a study to compare the hematological parameters and anthropometric indicators in hypertensive and normotensive males. Results showed that the mean levels of hemoglobin and hematocrit were significantly lower in the hypertensive group compared to the normotensives in the study. Sileshi B et al[12] aimed to compare hematological parameters between hypertensive and normotensive adult groups in Harar, eastern Ethiopia. The median ± IQR value of white blood cell (WBC) count, hemoglobin (Hb), hematocrit (HCT), red cell distribution width (RDW) and mean platelet volume (MPV) were significantly higher in hypertensive group compared to apparently healthy control group. Additionally, RBC (red blood cell) count, HCT and RDW showed statistically significant positive correlations with systolic and diastolic blood pressure. WBC count and RDW were significantly and positively correlated with body mass index (BMI). Platelet (PLT) count had a significant but negative correlation with duration of hypertension illness while MPV showed positive and significant correlation. Singh P et al[13] determine the association of hemoglobin, red blood cell (RBC) count, white blood cell (WBC) count, and platelets with the age, gender, and BMI of patients who came to the hematology section of the department in the regular outpatient department (OPD) services. A decline in hemoglobin (Hb) levels and RBC count was observed above 30 years, and it decreased more in females. The mean age of obese subgroup was found to be significantly more among males. Whereas, underweight and overweight were found to be significantly more among females. Hb, RBC, and platelet count did not show any significant difference among the subgroups of BMI category, but WBC count

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was found to be adequate in majority of the subjects with normal weight.[13] Tonelli M et al[14]examined the association between RDW and the risk of all-cause mortality and adverse cardiovascular outcomes in a population of people with coronary disease who were free of heart failure at baseline. A significant association was noted between baseline RDW level and the adjusted risk of all-cause mortality (hazard ratio per percent increase in RDW, 1.14; 95% confidence interval, 1.05 to 1.24). After categorization based on quartile of baseline RDW and further adjustment for hematocrit and other cardiovascular risk factors, a graded independent relation between RDW and death was observed (*P* for trend=0.001). For instance, participants with RDW in the highest quartile had an adjusted hazard ratio for death of 1.78 (95% confidence interval, 1.28 to 2.47) compared with those in the lowest quartile. Higher levels of RDW were also associated with increased risk of coronary death/nonfatal myocardial infarction, new symptomatic heart failure, and stroke.[14]

Conclusion

With the rise in the prevalence of overweight and obesity in the younger generation, the prevalence of hypertension has also been reported to have increased significantly. By using simple screening methods in younger ages, like measuring BMI, it is possible to identify individuals at high risk, at an early age. It was found that Hb and PCV increases with an increase in BMI, in hypertensive patients. The values of hematologic and plasma biochemical results as reported can be used by attending clinicians in evaluating health and disease in individuals.

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