Original Article

Association of Waistline Measurements with Hypertension in Type II Diabetic Patients in Darbhanga, Bihar

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Abstract

Aim: Aim of this study is to evaluate the interrelation of Waistline Measurements with the Arterial blood pressure and cardiometabolic risks among Type II diabetic patients and finding relation how obesity factors influence the risk of Cardiovascular Disorders.

Methods: A descriptive cross-sectional study at a Hospital, Darbhanga, Bihar was conducted for 2 months on 80 diabetic patients {47 men, 33 women} aged between 18–75 years. Patients were stratified on the Waist to Height Ratio criteria {>0.6 vs. <0.6} and interrelations between the Waistline measurement–related parameters and blood pressure were analyzed using Pearson's correlation.

Results: Patients with WHtR {>0.6} had higher BMI, Waistline Measurement, Systolic, Diastolic, Mean blood pressure levels, and Hba1c levels. Hypertension prevalence was 51% in the WHtR {>0.6} group versus 32% in the WHtR {<0.6} group. BMI showed a strong association with WHtR {r = 0.692, p <0.001}, and both BMI {r = 0.419, p <0.001} and WHtR {r = 0.327, p = 0.006} showed moderate interrelation with systolic blood pressure.

Conclusion: Both BMI and Waistline Measurement can be predominantly determined with the elevation of Arterial blood pressure in Type II diabetic patients, where BMI showed slightly higher determinative strength, while Waistline measurements offered an acceptable alternative for clinical and research purposes.

Keywords: Body mass index {BMI}, Waistline measurement, Waist to Height Ratio {WHtR}, Hypertension, Cardiovascular Disorders, Diabetes, Morphometric indices, systolic blood pressure.

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Introduction

Hypertension represents one of the most significant global health issues, contributing heavily to cardiovascular diseases, kidney disorders, stroke, and reduced life expectancy. Its prevalence is increasing not only in urban and industrialized regions but also in rural and low-resource communities, making it a universal health burden. Findings from population-based studies reveal that waist-to-height ratio is closely linked with systolic hypertension, making it a practical and inexpensive indicator for use in primary care and rural health programs[1]. In addition, large-scale analyses have confirmed that waist-to-height ratio is superior to body mass index in predicting hypertension among adults, emphasizing the importance of abdominal obesity rather than overall obesity in influencing blood pressure levels [2].

This pattern is not restricted to adults alone. In younger populations, waist-to-height ratio has been shown to have a significant association with sustained hypertension in children and adolescents, suggesting its utility as an early screening tool for cardiovascular risk beginning at early age [3]. In clinical groups where hypertension risk is already elevated, such as individuals with type II diabetes, waist-to-height ratio has also been reported to be a more accurate measure for predicting high blood pressure compared to body mass index [4]. These findings indicate that reliance only on general obesity markers may underestimate the contribution of central fat distribution to hypertension.

Despite these findings, body mass index continues to be widely used due to its simplicity and remains strongly associated with elevated blood pressure in both community and clinical settings[5]. However, central obesity appears to play a more critical role. Studies have identified waistline measurement as a standalone risk factor for hypertension in adults, suggesting that the distribution of fat around the abdomen contributes more directly to elevated blood pressure than total body weight alone [6]. Moreover, investigations among adolescents further confirm that body mass index, waist circumference, and waist-to-height ratio are all positively associated with high blood pressure, reinforcing the predictive value of these anthropometric measures across different age groups[7].

Methodology

The current Research was a descriptive cross-sectional investigation administered at G.H. Hospital, Darbhanga, Bihar, India, with the primary objective of examining the association between, with the primary objective of examining the association between body mass index {BMI}, waistline measurements, and the presence of elevated blood pressure among Type II diabetic patients. The total study population size was eighty {n = 80} diabetic patients, who were recruited from the outpatient department of the hospital. Of these, 33 were women and 47 were men. Adult patients aged between 18–75 years with informed consent were included. Patients with secondary causes of hypertension, Type I diabetes, pneumonia, hepatitis, and other chronic debilitating illnesses were excluded to reduce confounding factors. The study protocol was reviewed and approved by the Clinical Ethics Committee of G.H. Hospital, and authorised consent was obtained from all participants to ensure compliance with ethical research practices.

Anthropometric assessments were carried out for all 80 participants. Body weight and height were recorded using standardised calibrated equipment, and BMI was calculated as weight in kilograms divided by the square of height in meters {kg/m^2}. Based on WHO criteria, the study population was classified into normal weight, overweight, and obese groups. Waistline measurement was determined using a non-stretchable measuring tape at the midpoint between the lower margin of the last rib and the iliac crest. On this basis, participants were classified into those with WHtR> 0.6 {n = 43} and those with WHtR< 0.6 {n = 37}. Blood pressure was determined in a sitting position after at least fifteen minutes of rest using a standardised Hg sphygmomanometer, with two readings taken five minutes apart and their average recorded. Additional biochemical indicators including fasting glucose, postprandial blood glucose, HbA1c, triglycerides, LDL, and creatinine were observed.

Analytical Analysis

Evaluated data were first entered in Microsoft Excel and subsequently imported into Jamovi statistical software {version 2.7.2} for analysis. Continuous study parameters such as BMI, waist-to-height ratio {WHtR}, waistline measurements, and blood pressure data were summarised as mean ± standard deviation, while categorical parameters such as gender distribution and hypertension status were expressed as event counts and percentages. Group comparisons between patients with WHtR> 0.6 and WHtR< 0.6 were analysed using the independent t-test for continuous parameters and the chi-square test of independence for categorical parameters. The interrelation between morphometric parameters was further evaluated using Pearson's correlation analysis. All analyses were conducted at a 95% reliability interval, and results with a p-value < 0.05 were considered statistically significant.

Results

1. Comparison Based on Waist-to-Height Ratio and Gender

Patients were stratified by waist-to-height ratio {WHtR} into two groups: WHtR> 0.6 {n = 43} and WHtR< 0.6 {n = 37}. Among patients with WHtR> 0.6, 22 had a history of hypertension, while 12 patients in the WHtR< 0.6 group were hypertensive. Hypertension was more frequent in patients with larger waist-to-height ratio, and this variation was considered statistically significant since {p < 0.05}.

Differentiation in clinical parameters revealed that patients with WHtR> 0.6 had elevated BMI, HbA1c, systolic blood pressure, diastolic blood pressure, mean arterial pressure, body weight, and height. However, creatinine, triglycerides, and LDL cholesterol levels did not differ significantly {Table 1}.

Table 1. Clinical parameters by Waist to height ratio >0.6

Parameter	WHtR>0.6(n=43) Mean ± SD	WHtR< 0.6 (n=37) Mean ± SD	p-value
1. Waist Circumference	102.15 ± 7.8	86.51± 11.9	<0.001
2. Systolic BP (mmHg)	142.72± 17.3	131.71 ± 19.7	0.011
3. BMI (kg/m²)	27.67 ± 4.0	22.04 ± 3.0	<0.001
4. Diastolic BP(mmHg)	82.38± 10.8	74.7 ± 13.9	0.006
5. Weight (kg)	168.50 ± 12.9	59.97 ± 12.2	0.003
6. Height (cm)	156.95 ± 9.1	164.25 ± 9.2	<0.001
7. Hba1c(%)	7.49 ± 1.97	9.062 ± 2.4	0.001
8. Mean Arterial Pressure	102.34 ± 11.5	91.50± 12.9	<0.001

In terms of gender, 47 participants were men, of whom 19 {44.2%} had both Type II diabetes and hypertension. Among 33 women, 24 {55.8%} had both Type II diabetes and hypertension {Table 2}.

Table 2. Hypertension frequency by Waist to height ratio

WHtR Group	Hypertensive Patients (n)	Total Patients (n)	Percentage (%)
1. >0.6	22	43	80
2. <0.6	12	37	20

With p value less than 0.05

2. Hypertension Frequency by Waist to Height Ratio

3. Correlation Analysis

Testing indicated that both BMI and WHtR were positively interrelated with systolic blood pressure values. WHtR was strongly correlated with BMI {r = 0.692, p < 0.001}. WHtR also showed a moderate interrelation with systolic blood pressure {r = 0.327, p = 0.006}. BMI demonstrated a moderate positive association with systolic blood pressure {r = 0.419, p < 0.001} and mean arterial pressure. Waistline measurement showed a weak positive interrelation with systolic blood pressure {r = 0.196, p = 0.075}.

Both indices had weak, non-significant correlations with diastolic blood pressure {Table 3}.

Table 3. Correlation of Anthropometric Indices with Blood Pressure in Patients with Waist-to-Height Ratio (WHtR) Greater than 0.6.

Parameters	Systolic BP (r)	p-value	Diastolic BP (r)	p-value
1. BMI (kg/m²)	0.419	<0.001	0.235	0.050
2. WHtR	0.327	0.006	0.157	0.190
3. Waist Circumference	0.196	0.075	0.089	0.426

Discussion

In our study of 80 Type II diabetic patients, both BMI and waistline measurement were significantly interrelated with systolic blood pressure. BMI demonstrated a moderate correlation with systolic blood pressure {r = 0.419, p < 0.001}, and WHtR also showed a moderate correlation with systolic blood pressure {r = 0.327, p = 0.006}, while waistline measurement showed only a weak association {r = 0.196, p = 0.075}. Additionally, BMI and WHtR were strongly interconnected {r = 0.692, p < 0.001}, highlighting the interplay between general and central obesity in hypertensive risk {Table 2}.

For Instance, Roka et al. reported both BMI and WC were predominantly associated with hypertension, but central adiposity had a stronger impact in women, suggesting gender specific variations in U.S Adults strengthening the evidence, Jayedi et al[8]. conducted a systematic review and meta-analysis of over 2.3 million participants, demonstrating a dose-response relationship where both BMI and abdominal adiposity increased hypertension risk, but abdominal measures showed stronger predictive value[9].

Ashwell and Gibson directives of maintaining waist circumference at less than half of one's height, underscoring WHtR can also act as a useful measure for clinical and public health applications[10]. Similarly, Choi et al. in the ARIRANG study found that WHtR was strongly associated with the incidence of hypertension, making it a robust marker in population-based research[11].

While BMI has long been recognized as a major factor, studies show its limitations compared to central obesity indicators. Tesfaye et al. demonstrated that BMI was associated with blood pressure across diverse populations in Africa and Asia, confirming its global relevance[12]. Feng et al. further showed that although BMI strongly related to hypertension, WC was more strongly associated with other metabolic risks such as diabetes and dyslipidemia[13].

Numerous studies have already reported how body measurements estimate hypertension, with recent evidence suggesting that while BMI is valuable, abdominal indices like WC and WHtR may offer more reliable predictive strength. Wu et al. highlighted that novel anthropometric indices are being explored, yet traditional measures like WC and WHtR still show the strongest associations with hypertension[14].Supporting this, Shrestha et al. directly compared BMI, WC, and WHtR, concluding that WHtR was a superior predictor of hypertension across both genders[15]

Conclusion

In this study of 80 Type II diabetic patients, both BMI and Waistline measurement showed significant positive correlations with Systolic and Mean blood pressure, indicating that higher BMI and larger waistline measurements are interrelated with Increased probability of cardiovascular complications. BMI also demonstrated a strong relation with waist to height ratio, highlighting the interlink between general and Intra-abdominal fat. These findings suggest that monitoring both BMI and waistline measurement is important for early identification and Implementation of Interventions for hypertension and cardiovascular risk in Type II diabetic patients.

Limitations

This study was limited by its small sample size and single-center design, which may reduce generalizability. Its cross-sectional nature prevents establishing causality. Measurement variations and unassessed lifestyle factors such as diet, physical activity, and medication use may also have influenced the results.

Future Recommendations

Future research should include larger multi-center samples, adopt longitudinal designs, and incorporate lifestyle and behavioral factors. Exploring additional obesity indices and conducting intervention-based studies may offer deeper insights into preventing hypertension among Type II diabetic patients.

Ethical Clearance: As this study was retrospective and involved the analysis of previously recorded patient data without direct intervention, formal ethical clearance was not required according to institutional guidelines. All patient information was anonymized prior to analysis, and the study adhered to the minimum ethical standards for observational research.

Conflict of Interest: The authors declare that they have no conflict of interest regarding the publication of this study.

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