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Physical Anthropometry Influences Arterial Stiffness in Hypertensive Patients of North Karnataka

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Very less is known about the influence of Physical Anthropometry on arterial stiffness in hypertensive patients. Objectives: The study aimed to find out influences of physical anthropometry on arterial stiffness in hypertensive patients. Age matched participants were divided into 2 groups (group 1, control, n = 36; group 2, hypertensive patients, n = 73). Waist Circumference (WC), Body Mass Index (BMI), Waist Hip ratio (WHR) which is the markers of obesity was measured. Blood pressure (BP) was recorded manually in resting posture using sphygmomanometer. Arterial Stiffness Index (ASI) which is linked with hypertension was recorded by Periscope which work based on oscillometric method. The results were expressed as mean + SD. We did correlation between our variables using Spearman's correlation considering $p<0.05$ as statistically significant. Obesity indexes and arterial stiffness index were found to be higher in hypertensive patients as compared to its respective controls. There were significant positive correlation between the obesity indexes and arterial stiffness index in group 1 and group 2. These observations are indicative of influences of physical anthropometry in hypertension.

Keywords: Arterial Stiffness; Hypertension; Physical anthropometry.

Arterial stiffness is underlying cause of cardiovascular diseases like endothelial dysfunction, atherosclerosis and hypertension.[1, 2] Arterial stiffness (AS), which is considered as one of the early markers of vascular ageing, associated with changes in physical characteristics of the vessel wall, such as distensibility, elasticity, and complacency.[3] Arterial stiffness also predicts future cardiovascular diseases like hypertension and considered as its independent risk factor.[4, 5]

The relationship between physical anthropometry and arterial stiffness is not completely understood. Hence, present study has been undertaken to assess the relationships between

physical anthropometry and arterial stiffness in relation to hypertension.

MATERIALS AND METHODS

The present study is a prospective case control study. Institutional ethical clearance was obtained (IEC/No-09/2021 Dated 22/01/2021). Voluntary informed written consent was obtained from all the participants. All the parameters were recorded in the supine posture after rest for 10 minutes between 9AM to 11AM at room temperature. Study included 109 participants divided into group 1 (control, n = 36) and group 2 (hypertensive, n = 73) from both the sexes (age range: 35 to 50 years) of Vijayapur City, Karnataka. Subjects with chronic smokers, alcoholics, diabetes, patients with thyroid diseases and antihypertensive treatments were excluded from the study.

Anthropometric and Physiological assessment

Height (cm), weight (kg), waist circumference (cm), hip circumference (cm) and waist hip ratio were measured by using stadiometer and measuring tape respectively. BMI (kg/m^2) was conventionally calculated as weight/height^2 for each participant. Systolic blood pressure (SBP, mmHg) and diastolic blood pressure (DBP, mmHg) were recorded using mercury sphygmomanometer. All the parameters were recorded three times for each of the participant and the mean value was considered.[6, 7]

Calculation of Arterial Stiffness Index (ASI)

Arterial stiffness Index (ASI) were recorded in right (ASI_{RB}) and left (ASI_{LB}) brachial arteries by using Periscope, a non-invasive automatic device, which work on oscillometric method (Periscope, Genesis Medical Systems, India).[8, 9] The values were calculated by quantifying the oscillometric envelopes which were obtained from the oscillations in the respective artery.

ASI = [Systolic side value of cuff pressure at 80% of maximal oscillation amplitude of cuff] " [Diastolic side value of cuff pressure at 80% of maximal oscillation amplitude of cuff].

All recording were done in supine position and operational bias was avoided as the device is fully automated.

Statistical Analysis

The data was analyzed using MS-excel and JMP Pro 16 and presented in mean ±SD. To compare variables of study and control group Mann Whitney U Test was applied. Spearman's correlation was used to find the relationship between the variables. *pd" 0.05 was considered as significant.

RESULTS

Out of the 109 participants, we observed that the mean values of anthropometric parameters (BMI, Waist Circumference, Waist: Hip Ratio) and parameters of arterial stiffness (ASI_{RB}, ASI_{LB}) were significantly higher in the study group (group 2) as compared to the control group (group 1) (Table: 1). A positive correlation between anthropometric parameters and arterial stiffness parameters among the participants were also observed (Table: 2).

Table 1. Physiological Anthropometry variables and ASI of controls and study group

Variables	Group 1, control (n=36)	Group 2, hypertensive (n=73)	Mann Whitney U Test
Age (years)	42.75 ± 5.654	44.00 ± 5.320	NS
BMI (kg/m^2)	22.94 ± 1.330	26.47 ± 3.675	p<0.001
WC (cm)	82.50 ± 3.613	94.82 ± 7.934	p<0.001
WHR (WC:HC)	0.984 ±0.033	1.00 ± 0.133	p<0.001
SBP (mmHg)	115.89 ± 3.446	140.99 ± 9.322	p<0.001
DBP (mmHg)	72.44 ± 5.474	86.68 ± 6.121	p<0.001
Right Brachial ASI (mmHg)	22.522 ± 4.131	30.493 ± 8.167	p<0.001
Left Brachial ASI (mmHg)	22.050 ± 6.066	30.863 ± 7.796	p<0.001

Data represented in the form of mean ± SD. *p ≤0.05 is taken as statistically significant. BMI, Body Mass Index ; WC, Waist Circumference ; WHR, Waist Hip Ratio ; NS, Not Significant.

Table 2. Correlation between Physical Anthropometry (BMI, WC and WHR) and Arterial stiffness Index (Right and Left brachial ASI) in hypertensive group (group 2, n = 73)

Parameter	Right Brachial ASI (ASI_{RB})	Left Brachial ASI (ASI_{LB})
BMI	r = 0.353*	r =0.284*
WC	r = 0.174*	r = 0.148*
WHR	r = 0.519*	r = 0.448*

*$p \leq 0.05$ is taken as statistically significant

DISCUSSION

Present study showed increase BMI, WC, WHR in hypertensive group that indicate physical anthropometry pertaining to height, body weight and adiposity effect arterial stiffness by altered vascular pathophysiology. Alteration of vascular integrity resulting in hypertension and other associated cardiovascular diseases. [10] Increased ASI in hypertensive subjects also affect microvascular internal environment of physiological system especially cardiovascular, cerebrovascular and nephrovascular homeostasis resulting in possible serious cardiovascular diseases like hypertension, heart failure, myocardial ischaemia or neurovascular complications like stroke, carotid stenosis, vertebral stenosis and intracranial stenosis etc. [11]

Positive correlation between BMI with ASI_{RB} and ASI_{LB}, WC with ASI_{RB} and ASI_{LB} and WHR with ASI_{RB} and ASI_{LB} further confirms influences of physical anthropometry with severity of arterial stiffness. [12] Increase in collagen fibers and connective tissue, disarrangement in the arterial elastic laminae might be the reason for the altered physical anthropometry induced adiposity probably brings changes in the arterial stiffness.[13, 14]

CONCLUSION

Anthropometric parameters may be considered as risk factors for arterial stiffening in the development of hypertension. Arterial stiffness index can be a tool for screening patients at risk of cardiovascular diseases.

Conflict of Interest

There are no conflicts of interest.

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