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Original Research Article

To study the hip circumference to neck circumference ratio and neck circumference as a risk factor for coronary artery disease

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Abstract
Background: *Upper body subcutaneous fat, as estimated by neck circumference, may confer risk above and beyond visceral abdominal fat. Anatomically, upper-body subcutaneous fat is a unique fat depot located in a separate compartment compared with visceral adipose tissue.*
Aims and Objective: *to determine the reliability of neck circumference as a measure of obesity and as a marker of coronary artery disease as compared to BMI or waist circumference.(W/H ratio) and to identify the cutoff point for overweight and obesity for young adults using neck circumference.*
Material and Method: *It was prospective case control study. Data collected from tertiary care centre, Jabalpur over the period of one year. Data was analyzed using paired t test and chi square test.*
Result: In our study neck circumference ≥35.5 cms in males and ≥30.4 cms in females is significantly associated with the CAD , as p value is <0.05 in both male and female patients having CAD.
Conclusion: *Age of onset of Coronary artery disease is less in males as compared to female.*
Neck circumference ≥35.5 cms in males and ≥30.4 cms infemales was significantly associated with the CAD. It is a good clinical measure for screening CAD patient .It may also be a useful alternative to waist circumference in persons with flabby / distended abdomen due to various muscular medical or surgical causes.
Keywords: *Neck circumference, Coronary artery disease, Obesity, BMI.*

Introduction

Coronary artery diseases (CAD) comprises of spectrum from asymptomatic IHD (ischemic heart disease), angina pectoris to acute myocardial infarction.[1] Cardiovascular diseases comprise the most prevalent serious disorders in industrialized nations and are a rapidly growing problem in developing nations. Age-adjusted death rates for coronary heart disease have declined by two-thirds in the last 4 decades in the United States, reflecting the identification and reduction of risk factors as well as improved treatments and interventions for the management of coronary artery disease, arrhythmias, and heart failure. Nonetheless, cardiovascular diseases remain the most common causes of death, responsible for 35% of all deaths, almost 1 million deaths each year. Approximately one-fourth of these deaths

are sudden. In addition, cardiovascular diseases are highly prevalent, diagnosed in 80 million adults, or ~35% of the adult population.[1] The growing prevalence of obesity, type 2 diabetes mellitus, and metabolic syndrome, which are important risk factors for atherosclerosis, now threatens to reverse the progress that has been made in the age-adjusted reduction in the mortality rate of coronary heart disease.

Obesity is a state of excess adipose tissue mass. Although not a direct measure of adiposity the most widely used method to judge obesity is body mass index (BMI).[2] Other approaches to quantifying obesity anthropometry skin fold thickness, densitometry (underwater weighing), computed tomography (CT), or MRI and electrical impedance upper subcutaneous body fat as estimated by NC confer risk above and beyond visceral abdominal fat. Various studies indicated that NC is independent correlate of metabolic risk factors beyond BMI and waist circumference.[2] Besides NC is considered an index of upper body obesity and correlated positively with changes in systolic and diastolic blood pressure and other components of metabolic syndrome.[3]

It is observed that individuals with upper body obesity i,e fat accumulation in the subcutaneous, abdominal, visceral and in neck region are prone to metabolic and cardiovascular complications specially when there is excess fat in these areas. Release of free fatty acid is more from upper body fat as compared to lower body fat.[4] The enhanced total lipolytic lipolytic activity in upper body fat is more in visceral than subcutaneous fat probably contributes significantly to the FFA levels in systemic circulation.[5] Elevated free fatty acid concentrations have been associated with insulin resistance, increased very-low-density lipoprotein cholesterol production, and endothelial cell dysfunction.[6] Some studies have indicated that neck circumference may be an independent correlate of metabolic risk factors above and beyond BMI and waist circumference. [7-10]

Aims and Objectives

- To determine the reliability of neck circumference as a measure of obesity and as a marker of coronary artery disease as compared to BMI or waist circumference. (W/H ratio)
- To identify the cutoff point for overweight and obesity for young adults using neck circumference.

Material and Method

It is hospital based case control study done at tertiary care centre Jabalpur. Data collected from 75 cases and 70 controls and statistical analysis done.

Inclusion criteria: all patients with coronary artery disease admitted in medicine department during study period giving consent.

Exclusion criteria

- Local neck swelling.
- Local or diffuse abdominal swelling.
- Multigravida female with laxity of rectus abdominis muscle.
- Patients not giving consent for to be part of study.

Observation and Result

Table1: Age distribution of cases and control

Age (years)	Cases (CHD)		Control (Non CHD)	
	Number	%	Number	%
30-35	1	1.3%	6	8.6%
36-40	2	2.7%	10	14.3%
41-45	9	12%	8	11.4%
46-50	10	13.3%	12	17.1%
51-55	10	13.3%	10	14.3%
56-60	18	24%	15	21.4%
61-65	13	17.3%	5	7.1%
>65	12	16%	4	5.7%

Coronary artery disease is common after the age of 40 years. Age of onset is around 10 years earlier in males compared to females.(In females maximum number of CAD patients are > 50 years of age).

In our study among study group 77.33% (58) patients were male and 22.67% (17) patients were female.

Table 2: Distribution of CHD patients according to BMI

BMI	Frequency	Percentage
≤22.9	10	13.3
23-24.9	17	22.66
>24.9	48	64
Total	75	100

Maximum number of coronary artery disease patients were having BMI >24.9 kg/m^2. (Obese individuals).

Table 3: Median neck Circumference (in centimeters) in overweight and obese category

BMI	Number of cases	Median neck circumference	Standard deviation
≤22.9	10	31	2.30641
23-24.9	17	32	2.47787
>24.9	48	36.6	3.62630
Total	75	33	3.83648

For Overweight median neck circumference was 32 ± 2.47787 cms, and for Obese median neck circumference was 36 ± 3.6263 cms.

Table 4: Cut off value of neck circumference and hip to neck circumference ratio

Sex	Cut-off	CHD		Non CHD		P-value
		N	%	N	%	
Male	<35.5	13	22.8	37	92.5	0.0001
	≥35.5	44	77.2	03	7.5	
Female	<30.4	07	38.9	22	73.3	0.021
	≥30.4	11	61.1	08	26.7	

In our study neck circumference ≥35.5 cms in males and ≥30.4 cms in females is significantly associated with the CAD .As p value is <0.05in both male and female patients having CAD.

Hip to Neck Circumference ratio- It is seen that there is inverse relationship between hip to neck circumference ratio and neck circumference (it is observed that in obese patients neck circumference increases more when compared with hip circumference).

Discussion

Obesity is an evolving health problem in both developed and developing countries. Traditional obesity indices as Body- Mass Index (BMI), Waist circumference (WC), Waist- Hip Ratio (WHR) are well known measures to identify obese subjects.

The present study was carried out to find out hip circumference to neck circumference ratio and cut off value of NC as a risk factor for CAD, and also as a marker for overweight and obesity.

During the study period total 371 patients were diagnosed as a CHD patient. Out of which 75 cases were taken in study (who fulfilled inclusion criteria).

Table no.1 Shows Coronary artery disease is common after the age of 40 years. Age of onset is around 10 years earlier in males as compared with female. (In females maximum number of CAD patients are > 50 years of age). Similar results were found by Pekka Jousilahti et al in study on Sex, Age, Cardiovascular Risk Factors, and Coronary Heart Disease.[11]

Table no.2 Shows that maximum number of coronary artery disease patients having BMI >24.9 kg/m^2. Previous study by Gupta R et al on Body – Mass Index, Waist- Hip Ratio and cardiovascular risk factors shows significant positive correlation of BMI with coronary artery disease.[12]

Table no. 3 Shows that the median neck circumference of patients and found that in, non overweight non obese patients median neck circumference was (31± 2.60341cms), in

overweight patients median neck circumference was (32 ± 2.47787 cms) and for Obese patients median neck circumference was (36± 3.6263 cms) and the difference in the groups was highly significant.(p=0.0001). Previous study by Ben-Noun et al in which Neck circumference used as a simple measure for identifying overweight and obese patients, they were defined the cut off value of neck circumference for overweight and obese patients. They suggested that men with NC <37 cm and women with NC <34 cm are not to be considered overweight, patients with NC ≥37 cm for men and ≥34 cm for women require additional evaluation of overweight or obesity status.[13]

Table no.4 Shows that Neck circumference ≥ 35.5 cms in males and ≥ 30.4 cms in females was significantly associated(p<0.0001 for males and p=0.021 for females) with the CAD in both male and females. This may be a useful sign in persons with flabby /distended abdomen due to various causes. Previous study by Sharma R.S, Rao V.G Jan 2011- in which neck circumference was correlated with MI and other measures of cardiometabolic risk factors they found that neck circumference was 42.2cms in males & 37.1 cms in females which correlated with BMI and it was significant. (P<0.001).[14]Also study by JPMA(Journal of Pakistan medical association) by Hingorjo MR, Querashi MA, Mehdi A, on Neck circumference as a useful marker of CAD, they found that NC ≥ 37.5 cm in males and ≥ 32 cms in females is associated with CAD (p<0.05).[15]

Hip to Neck Circumference ratio- It is seen that there is inverse relationship between hip to neck circumference ratio and neck circumference (it is observed that in obese patients neck circumference increases more when compared with hip circumference).

Conclusion

Age of onset of Coronary artery disease is less (early onset) in males as compared to female.(40 years for males and 50 years for females).

Neck circumference ≥35.5 cms in males and ≥30.4 cms in females was significantly associated with the CAD.It is a good clinical measure for screening CAD patient .It may also be a useful alternative to waist circumference in persons with flabby/distended abdomen due to various muscular medical or surgical causes.

There is inverse relationship between hip to neck circumference ratio and neck circumference (it is observed that in obese patients neck circumference increases more when compared with hip circumference).

When compared with males, females had 0.42 times chances of CAD in univariate analysis but when multiple variables were used no difference in sex was found for risk of CAD.

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