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RESEARCH ARTICLE

TO STUDY THYROID DYSFUNCTION IN PATIENTS WITH METABOLIC SYNDROME

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Abstract

Background: Metabolic syndrome (MetS) is a cluster of risk factors associated with increased cardiovascular disease and diabetes risk. Thyroid dysfunction (TD), especially hypothyroidism, has been observed more frequently in individuals with MetS. However, the relationship between thyroid function and metabolic syndrome components remains debated. This study aimed to explore the prevalence of thyroid dysfunction and its association with metabolic syndrome components in patients.

Methods: A cross-sectional study was conducted at Sri Aurobindo Medical College & P.G. Institute, Indore. A total of 120 patients meeting the International Diabetes Federation (IDF) criteria for metabolic syndrome were included. Detailed history, anthropometric measurements, blood pressure recordings, fasting blood sugar, lipid profile, and thyroid assays were performed. Statistical analysis using SPSS22 and Excel was employed to assess thyroid dysfunction prevalence and its correlation with metabolic syndrome components.

Results: Among 120 patients with metabolic syndrome, 28% had thyroid dysfunction. Hypothyroidism was predominant, with subclinical hypothyroidism being the most common type. Females and older individuals (>45 years) showed a higher prevalence of thyroid dysfunction. Patients with thyroid dysfunction exhibited altered metabolic syndrome components, including increased waist circumference, decreased HDL-C, elevated blood pressure, fasting glucose, and triglyceride levels.

Conclusion: The study highlights a high prevalence of thyroid dysfunction, especially hypothyroidism, among patients with metabolic syndrome. These findings suggest a potential association between thyroid status and metabolic syndrome components. Screening for thyroid dysfunction in individuals with metabolic syndrome could aid in optimizing clinical management strategies. Further research with larger sample sizes and prospective designs is warranted to explore the impact of thyroid dysfunction management on metabolic syndrome outcomes.

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Introduction:-

Metabolic syndrome is a group of risk factors that includes high blood pressure, unhealthy cholesterol levels, high blood sugar, and conditions that increase the risk of blood clots and inflammation [1]. This collection of metabolic abnormalities is linked to a higher likelihood of developing atherosclerotic cardiovascular disease and type 2 diabetes mellitus [2]. The global incidence of metabolic syndrome is on the rise, particularly in India and other South Asian nations, as evidenced by numerous studies [3].

Thyroid dysfunction, particularly subclinical hypothyroidism, has been found to occur more often in patients with metabolic syndrome compared to the general population [3]. Metabolic syndrome and hypothyroidism are separate risk factors for cardiovascular diseases (CVD). The coexistence of these disorders can exacerbate the risk for cardiovascular disease (CVD), as there is a significant overlap in the underlying mechanisms of atherosclerotic cardiovascular disease caused by metabolic syndrome and hypothyroidism [4]. Studies have found that individuals with metabolic syndrome had higher levels of thyroid stimulating hormone (TSH) compared to healthy individuals. Additionally, there is a greater occurrence of metabolic syndrome in those with higher-than-normal TSH levels compared to those with normal TSH levels [5, 6]. Nevertheless, the connection between thyroid dysfunction and elements of metabolic syndrome remains a subject of debate [7].

Patients with metabolic syndrome who are at a higher risk for cardiovascular disease may need to have their thyroid function checked, as there is evidence suggesting a potential link between the two. Thyroid dysfunction is a frequently occurring condition in Nepal, with the frequency of diabetes mellitus and metabolic syndrome constantly increasing. According to reports, 20.7% of the population in Nepal have metabolic syndrome as determined by the National Cholesterol Education Program (NCEP) guidelines [8, 9]. Nevertheless, the investigation of thyroid function in these patients is lacking. A research conducted by Gyawali et al. in the central area of Nepal found that 31.8% of individuals with metabolic syndrome had thyroid dysfunction [3]. The purpose of our study was to evaluate the prevalence of thyroid dysfunction and investigate the possible connection between metabolic syndrome components and thyroid function in patients from the eastern region of Nepal. Our findings aim to contribute to the improvement of clinical management for individuals with metabolic syndrome. The objective of this study is to assess the prevalence of thyroid dysfunction among individuals with metabolic syndrome.

This study aimed to evaluate thyroid function and investigate the correlation between metabolic syndrome components and thyroid function in a population diagnosed with metabolic syndrome.

Materials and Methods:-

The present study is a Cross Sectional Study done in medicine department Sri Aurobindo Medical College & P.G. institute, Indore (M.P.). A total of 120 Patients with metabolic syndrome fulfilling IDF criteria were selected the study. Detailed history of medication, and anthropometric measurements were noted in a semi-structured pro-forma. Blood pressure was recorded in right upper limb in sitting posture. After eight hours of fasting, blood drawn for fasting blood sugar, lipid profile and thyroid assay in a single sitting. Then statistical analysis made using SPSS22 and excel The patients who fulfilled the criteria of metabolic syndrome as defined by IDF 2005(table 1) were taken up for this study. While Known Hypothyroid / Sub clinical Hypothyroid , Patients with chronic illness., on steroids, severely ill patients, Pregnant Women and Individuals age below 18 years were excluded. All the patients diagnosed with metabolic syndrome will be thoroughly investigated. All the relevant personal history and medical history will be obtained.

Table 1:- Criteria Defining Metabolic Syndrome(Mets).

	IDF
Waist circumference (adiposity)	>94cm♂(European) >90cm♂(Asiatic) >80cm♀
Serum glucose	⩾100mg/dl
Triglycerides	⩾150mg/dl

HDL-c	<40mg/dl♂ <45mg/dl♀
Blood pressure	SystolicBP⩾130mmHg ordiastolicBP⩾85mmHg or HBP treatment

Table 2:- Definitions For Deferent Grades Of Thyroid Dysfunction.

Parameters	**Hyper Overt Overt**	**Subclinical hypothyroidism**	Hypothyroidism Overt	Subclinical
TSH(μIU/mL)	<0.45	<0.45	>4.50	>4.50
FT4(ng/dL)	>1.8	0.8-1.8	<0.8	0.8-1.8
FT3(pg/mL)	>4.4	1.4-4.4	<1.4	1.4-4.4
TSH: thyroid-stimulating hormone; FT4: free thyroxine; FT3: free triiodothyronine.				

Results:-

Table 3 provides a comprehensive overview of the demographics and baseline characteristics of 432 patients diagnosed with metabolic syndrome. The sample is divided into two age groups: those aged 45 years or younger (N=49) and those older than 45 years (N=71), with a total sample size of 120 individuals. The mean age for the younger group is 36.7 years (SD=6.08), while the mean age for the older group is 55.6 years (SD=5.52), resulting in an overall mean age of 47.9 years (SD=10.96) across the entire cohort. Gender distribution shows that 58.56% of the total sample are women, with 41.10% in the younger age group and 58.43% in the older age group. Men constitute 41.44% of the total sample, with 58.9% in the younger age group and 41.57% in the older age group. Other parameters such as height, weight, waist circumference, and hip circumference are also provided, showcasing mean values and standard deviations for each age group and the total sample.

Table 3:- Demographics and baseline characteristics of 120 patients with metabolic syndrome.

Parameter	**Age≤45y(N=49)**	**Age>45y(N=71)**	Total(N=120)
Ageinyears			
Mean(SD)	36.7(6.08)	55.6(5.52)	47.9(10.96)
Range	21.0-45.0	46.0-65.0	21.0-65.0
Gender			
Women, N(%)	29(41.10%)	41(58.43%)	70(58.56%)
Men,N (%)	29(58.9%)	21(41.57%)	50(41.44%)
Heightincm,mean(SD)	163.0(9.02)	160.8(8.44)	161.7(8.74)
Weightinkg, mean(SD)	79.4(13.13)	75.8(12.29)	77.3(12.75)
Waistcircumferenceincm, mean(SD)	98.5(9.41)	98.7(9.92)	98.6(9.70)
Hipcircumferencein cm, mean(SD)	106.3(11.07)	104.7(11.14)	105.4(11.13)
SD: standard deviation.			

Table 4 presents the percentage prevalence of different grades of thyroid dysfunction among patients diagnosed with metabolic syndrome (MetS), with a total sample size of 120 individuals. Among these patients, 28.00% (N=34) were identified as having thyroid dysfunction. Specifically, 16.00% were diagnosed with hypothyroidism, with 1.60% exhibiting new overt hypothyroidism and 8.10% showing new subclinical hypothyroidism. Hyperthyroidism was observed in 1.60% of patients, including 0.83% with new subclinical hyperthyroidism. No new cases of overt hyperthyroidism were reported in this sample. These findings provide insights into the prevalence and classification of thyroid dysfunction within the context of metabolic syndrome.

Table 3:- Percentage Prevalence of Deferent Grades of Thyroid Dysfunction.

ClassificationofTD	**MetS patients (N=120) N(%)**
Hypothyroidism*	19(16.00)
New overt hypothyroidism	2 (1.60)

Newsubclinicalhypothyroidism	10(8.10)
Hyperthyroidism*	2 (1.60)
Newoverhyperthyroidism	0
Newsubclinicalhyperthyroidism	1 (0.83)
TotalnumberofTDpatients	34(28.00)

TD: thyroid dysfunction; MetS: metabolic syndrome.* Known cases of thyroid dysfunction.

Discussion:-

Thyroid hormones play a crucial role in controlling energy balance and the metabolism of glucose and lipids. As a result, they have an impact on the markers of metabolic syndrome, such as HDL-C, TG, blood pressure, and plasma glucose. Hypothyroidism has been observed to be linked with obesity, dyslipidemia, and an elevated risk of atherogenic cardiovascular disease [10]. In individuals diagnosed with hypothyroidism, insulin resistance (IR) is proposed as the potential underlying physiological cause for the development of glucose intolerance, if it is present [11].

The pathophysiology of MetS is thought to be exacerbated by oxidative stress, chronic inflammation, and angiogenesis [12]. Key elements of MetS, like hyperglycemia and inflammation, boost the generation of reactive oxygen species (ROS), leading to elevated oxidative stress by overactivation of nicotinamide adenine dinucleotide phosphate (NADPH) oxidase [13,14]. The primary reactive oxygen species (ROS) is the superoxide anion, which is generated by the enzyme NADPH oxidase [19]. Hyperthyroidism can cause a hypermetabolic state, which speeds up the formation of free radicals in mitochondria and leads to alterations in the antioxidant defense system. In cases of hypothyroidism, the presence of oxidative stress is a result of a decrease in the ability of the body's antioxidant defense system.

Our study found that 28% of the patients diagnosed with Metabolic Syndrome (MetS) also had Thyroid Dysfunction (TD). This is consistent with the findings of other research conducted in India [15, 16, 17].The high prevalence of hypothyroidism (both overt and subclinical: 25.7%) indicates that Metabolic Syndrome (MetS) may also result from different levels of hypothyroidism as the disease progresses. The recent instances of TD primarily consisted of subclinical hypothyroidism (8.10%) and were followed by overt hypothyroidism (1.60%).Additional research has also demonstrated comparable findings, with a higher prevalence of subclinical hypothyroidism (ranging from 14.6% to 53%) followed by overt hypothyroidism (3.5% to 7.4%) [15, 18–21].The lower prevalence of subclinical hypothyroidism cases (8.10%) observed in our study can be explained by the significant inclusion of individuals with diagnosed hypothyroidism (16%) who were already receiving levothyroxine medication. The total prevalence of hypothyroidism, including baseline cases (16%), new cases of overt hypothyroidism (1.60%), and new cases of subclinical hypothyroidism (8.10%), was determined to be 25.70%. Consistent with our research, other Indian studies, such as Kota et al. (26%) [15] and Shantha et al. (29.3%) [18], have also revealed a similar occurrence of hypothyroidism in the MetS community.

In our study, women with MetS had a significantly greater incidence of TD compared to men (21.06% vs. 6.94%).This supports findings from other studies that have shown a higher frequency of TD in women compared to males in the context of MetS [22–24].Both men and women in the older age group (>45 years of age) showed a greater incidence of TD (men: 63% vs. 37%; women: 59% vs. 41%). The findings of our study were consistent with previous research, which indicated a propensity for TD to increase with age in both males and females [24,25]. Therefore, age and gender may serve as important risk factors for TD in patients with MetS, necessitating a thorough clinical and laboratory assessment in these specific populations.The study revealed that patients diagnosed with TD exhibited elevated waist circumference, decreased HDL-C, increased HOMA-IR, elevated systolic blood pressure, elevated diastolic blood pressure, elevated fasting glucose, and elevated TG levels, all of which are components of MetS. A greater percentage of females had waist circumferences over the cutoff point (>80cm) compared to males (>90cm; 75.21% vs. 23.97%). While other research have also found a connection between TD (Type 2 Diabetes) and components of MetS (Metabolic Syndrome), the matter is still subject to debate.A study conducted in Nigeria found a strong association between Metabolic Syndrome (MetS) and higher levels of Free Thyroxine (FT4) [26]. Kotaetal. discovered a substantial correlation between subclinical hypothyroidism and Metabolic Syndrome (MetS) in Indian patients. They also observed a relationship between TSH levels and TC, TG, LDL, and HDL-C values [15]. Nevertheless, a research conducted in Turkey found no correlation between TSH

and...The different elements of MetS, with the exception of HDL-C, were found to be associated with total T3, FT4, and FT3/FT4 ratio [27].

It is important to mention that when investigating the connection between thyroid dysfunction (TD) and components of metabolic syndrome (MetS), the majority of studies have mostly concentrated on subclinical hypothyroidism. Additionally, it is important to acknowledge that the occurrence of TD in MetS and its correlation with its components can differ depending on geographical location, age, gender, nutrition, genetics, and environmental factors [18,25,28].

There are several limitations of the current study.Due to the nature of this study being cross-sectional, it was not possible to establish a cause-and-effect relationship.Furthermore, the grades of hypothyroidism in the participants who were already taking levothyroxine supplementation could not be evaluated due to insufficient historical data. Furthermore, it is necessary to conduct a cohort study in order to assess the detrimental impact of TDon metabolic processes. Furthermore, the study did not evaluate the iodine dietary status or thyroid autoimmunity. Furthermore, the study did not evaluate the influence of age, gender, and body weight on thyroid functions.

Conclusion:-

The incidence of thyroid dysfunction in patients with metabolic syndrome was high, suggesting a potential interaction between thyroid status and metabolic syndrome.Hypothyroidism was the most prevalent thyroid disorder in Indian individuals with Metabolic Syndrome (MetS).The results obtained from the current study will help establish an association between TD (thyroid dysfunction) and MetS (metabolic syndrome) in Indian patients. These results will be of prognostic significance for practitioners in their everyday clinical practice to develop methods for improved care of their patients with TD and associated MetS. An early diagnosis of TD in MetS would facilitate the modification of the disease's progression by timely therapies involving suitable lifestyle modification regimens, as applicable.Nevertheless, it is necessary to conduct further research with a large sample size and a prospective design to assess the effect of TD management on the lowering of MetS and its associated components.

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