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RESEARCH ARTICLE

PREVALENCE OF METABOLIC SYNDROME AMONG THE PATIENTS AND STAFF OF A TERTIARY CARE HOSPITAL IN RANCHI, INDIA.

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Key words:-

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Abstract

Objectives: The prevalence of Metabolic Syndrome is rapidly increasing in India and other south Asian countries, leading to increased mortality and morbidity due to cardiovascular disease and Type 2 Diabetes mellitus. The following study was undertaken to assess the prevalence of Metabolic Syndrome among the patients and staff of a tertiary care hospital in Ranchi, India.

Materials and Methods: The study group comprised of 170 subjects with age group 18-60 years. The diagnosis of Metabolic Syndrome was done by NCEP ATP III (National Cholesterol Education Programme Third Adult Treatment Panel) criteria.

Results: The overall prevalence rate of Metabolic Syndrome was 20.6%. Among males and females the prevalence was 18.8% and 23% respectively. A high prevalence rate was observed among older age group, high socio economic group, and sedentary life style group. Hypertension, Impaired glucose tolerance, Hypertriglyceridemia, low serum HDL Cholesterol level and obesity significantly contributed to increased risk of Metabolic Syndrome.

Conclusion: A high prevalence of Metabolic syndrome in this part of eastern India necessitates the early identification of cases so that preventive and corrective strategies could be deployed to prevent the occurrence of Metabolic Syndrome and its complications among individuals at risk.

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Manuscript:-

The prevalence of Metabolic Syndrome is rapidly increasing in South Asian countries especially in India leading to increased morbidity and mortality due to CVD and Type2 diabetes mellitus(1,2).The Metabolic Syndrome(Syndrome x, Insulin resistance syndrome) consists of a constellation of metabolic abnormalities that confer increased risk of cardiovascular disease(CVD) and Type 2 diabetes mellitus(3).The metabolic syndrome is a cluster of risk factors like impaired glucose tolerance, abdominal obesity, atherogenic dyslipidemia and hypertension. It was estimated that 20-25% of the South Asians have developed Metabolic Syndrome and many more are at a great risk (4,5).

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It is now well established that Metabolic Syndrome is a risk factor for increased cardiovascular mortality and morbidity. Cardiovascular disease accounts about 20 % of all medical emergency admissions worldwide with a high mortality rate(6). A recent WHO study estimates that by 2020 ,CVD would be the leading cause of mortality in India with 2.6 million deaths(7,8). Several studies showed that, overall the diabetics have a two fold increase in risk of coronary heart disease(9). Angiographic data of Indian patients with suspected coronary artery disease had revealed that triple vessel disease was much higher in diabetics as compared to non-diabetics to be followed by double vessel disease while single vessel disease was more common in non-diabetics(10).

The fundamental mechanism that leads to the Metabolic syndrome still remains unknown. Many researchers have tried to put forward possible hypotheses and explanations for the mechanism that links the different components of the Metabolic syndrome. Insulin resistance, leptin resistance, obesity, beta-cell dysfunction, sympathetic over activity, reduced serotonergic responsivity, thrifty genotypes and candidate genes are some of the etiological factors that have been proposed to cause Metabolic syndrome. Besides these there are various risk factors like advancing age, gender, race ,ethnicity, family history, food habits and addictions, physical inactivity, psychological and personality factors have also shown their association with Metabolic Syndrome. In Urban population a fast paced life, professional stress, physical inactivity and food habits have lead to emergence of a large number of risk factors of various diseases. Metabolic syndrome is very important disease associated with these changes in life style and food habits. The population of Ranchi, the capital city of Jharkhand in the pace of competing with the speed of westernization, is rapidly inducing changes in the life style and diet and thus was selected for the present study. The outcome of the present study will help in evaluating current situation, so that effective preventive and treatment strategies could be deployed.

Materials and Methods:-

The study was conducted by the department of Biochemistry in collaboration with the department of Medicine, Rajendra Institute of Medical Sciences, Ranchi. The study included 170 subjects and was selected randomly from the patients, visiting various OPDs. Hospital medical and paramedical staffs were also enrolled for the study.

The study was commenced after taking the approval from the ethical committee of the institution and the patients were enrolled in the study after getting informed consent. The inclusion criteria were all the subjects with age group 18-60 years. Patients with the history suggestive of chronic hepatic or renal disease which might affect biochemical parameters were excluded from study.

The diagnosis of the cases were done by NCEP ATP III (National Cholesterol Education Programme Third Adult Treatment Panel) criteria (Table-1)

Table-1:- Diagnosis of Metabolic Syndrome (NCEP ATP III criteria)

The diagnosis of Metabolic Syndrome is made on the basis of presence of three or more of the following risk factors	
Abdominal obesity	Waist circumference:- Males >102cm (>40 inches) Females >88cm (>35 inches)
Serum Triglyceride	≥ 150 mg/dl
HDL-Cholesterol	Males < 40 mg/dl Females < 50 mg/dl
Blood Pressure	≥ 130/85 mm Hg
Fasting Blood Glucose	≥ 100 mg/dl

The study tool comprised of a interview, based on structured questionnaires which included subject identity, socioeconomic status (based on Kuppaswamy's socioeconomic scale) and details of classical risk factors like family history of hypertension, obesity, and diabetes .Questions also included items related to nutritional habits like vegetarian or non-vegetarian, addictions like chewing tobacco, smoking and alcoholism. Questions related to life style and physical activity was also recorded.

The anthropometric measurements were also recorded like, Body weight was determined with subjects wearing light clothes and no shoes or socks using an electronic balance and Height was determined using a wall mounted, non extendable measuring tape with subjects in standing position and feet together. Waist circumference was also

measured with the help of a measuring tape at the level midway between the lowest rib and the iliac crest. Blood pressure was measured using a standard sphygmomanometer.

The subjects were asked not to take any fatty food in the previous night. A fasting (at least 10 hrs) sample was collected under sterile condition into a plain vial and a fluoride vial. The method used for the estimation of serum triglyceride and HDL-Cholesterol was GPO-PAP (Glycerol-3-phosphate oxidase phenol aminophenazone) and Direct Clearance method respectively. GOD-PAP (Glucose oxidase phenol aminophenazine) method used for plasma glucose estimation. All the analytes were measured on Beckman Coulter AU 480 auto analyzer using commercial kits provided by Randox Industries, UK.

Statistical analysis:-

All statistical analysis were performed with the programme statistical package for the social science version 20.0(SPSS Inc,Chicago,Illinois).Significance difference in the proportion of potential life style factors by Metabolic Syndrome were estimated using Pearson's chi square test. A p value < 0.05 was accepted as statistically significant. Unpaired T-test (gender) and one way analysis of variance (age) was performed. The prevalence of Metabolic syndrome was calculated using the prevalence rate formula that is number of patients per total number of all subjects at the time of study multiplied by 100. Results were expressed as percentage (%).

Results:-

The whole study group was comprised of 170 subjects. Amongst these 29.4% belonged to 18-30 years age group, 38.8% belonged to 31-40 years age group, 20.6% belonged to 41-50 years age group and rest 11.2% belonged to 51-60 years age group. 56.5% of the study population were males and 43.5% were females. Vegetarians comprised of 30.6% and non-vegetarians were 69.4%. Major proportion of the study population belonged to middle socioeconomic status (65.3%).The high and low socio-economic status contributed 14.7% and 20 % of the study population respectively. 55.3% had moderately active life style. 25.9% had sedentary life style and 18.8% had active life style. 65.3% did not had any family history of diseases like hypertension, diabetes or obesity. Occupation wise 33.2% were housewives, 20.1% businessman, 19% were students,14.3% were in service, 6.7% had agriculture as occupation and rest 6.7% were labourers.

Table -2:- Prevalence of Metabolic Syndrome among different demographic characteristics

Variable	Subjects without MetS (n=135)		Subjects with MetS (n=35)		Total (n=170)	P value
	Number of subjects	% within the group	Number of subjects	% within the group		
Sex						
Male	78	81.2%	18	18.8%	56.5%	0.77
Female	57	77.0%	17	23.0%	43.5%	
Age						
18-30 years	49	98.0%	1	2.0%	29.4%	0.77
31-40 years	59	89.4%	7	10.6%	38.8%	
41-50 years	20	57.2%	15	42.8%	20.6%	
51-60 years	7	36.8%	12	63.2%	11.2%	
S/E Status						
High	11	45.0%	14	55.0%	14.6%	0.01
Low	32	94.2%	2	5.8%	20.0%	
Middle	92	82.9%	19	17.1%	65.4%	
Food Habit						
Non-veg	93	78.8%	25	21.2%	69.4%	0.09
veg	42	80.8%	10	19.2%	30.6%	
Life Style						
Active	29	89.5%	3	10.5%	18.9%	0.002
Mod.Active	75	79.5%	19	20.5%	55.3%	
Sedentary	31	70.5%	13	29.5%	25.8%	

MetS-Metabolic Syndrome, S/E Status-Socioeconomic status, Non-veg- Non-vegetarian ,veg- Vegetarian, Mod. Active- Moderately Active.

Table 2 showed the prevalence was highest (63.2%), among 51-60 age group. Prevalence in 18-30 years age group was lowest (2%).The prevalence among females was 23.0% and among males was 18.8%. A very high prevalence was observed in the high socioeconomic group, (55.0%). The prevalence in the middle and low socioeconomic group was 25.0% and 5.8% respectively. Among vegetarian the prevalence was 19.2% and among non-vegetarian the prevalence was 21.2%. Prevalence among active group was 10.5%. Prevalence among moderately active and sedentary lifestyle was 20.5% and 29.5% respectively. The overall prevalence of Metabolic Syndrome in the state of Ranchi was 20.6%.

Table-3 shows the prevalence of important study clinical characteristics among diagnosed cases of Metabolic Syndrome and among normal subjects.

Table 3:- Prevalence of Metabolic Syndrome among different clinical characteristics

Clinical characteristics	Normal subjects	Cases of Metabolic syndrome
Prevalence(%) of Hypertensives (B.P.≥ 130/85 mm of Hg)	24.5%	75.5%
Prevalence of impaired glucose tolerance (FPG ≥ 110)	29.9%	70.1%
Prevalence of Hypertriglyceridemia (≥ 150 mg/dl)	15.0%	85.0%
Prevalence of Low HDL (HDL < 40 mg/dl)	26.8%	73.2%
Prevalence of Obesity (BMI ≥ 30)	8.8%	91.2%

B.P.-Blood pressure, FPG- Fasting plasma glucose, HDL- High density lipoprotein BMI- Body mass index.

Discussion:-

The prevalence of Metabolic syndrome in India has shown an exponential increase in last few years in both rural and urban areas. In different parts of India the figure of Metabolic syndrome ranges from 11% to 41 % (11). After the analysis of our data, the results showed that 35 out of a total 170 study subjects were diagnosed as cases of Metabolic syndrome based upon NCEP ATP III diagnostic criteria. It was concluded that the prevalence of Metabolic Syndrome among the patients and staff in Rajendra institute of medical sciences, Ranchi (Tertiary care Hospital) was 20.6%.

The results obtained by Sawant et al showed a prevalence of 19.52% in an urban population in western India, which is comparable to the results obtained by our study (12). Our study findings do corroborate with the findings of Deepa et al (13). Likewise, a prevalence study of urban community in northern India reported a prevalence of 22.37% for Metabolic syndrome (14).Similar findings were also observed by Mishra et al who showed that one third of the urban populations in India's major cities had Metabolic Syndrome (15).Study done by Prasad DS et al found the prevalence of Metabolic syndrome among urban eastern Indian population was 33.5% which is greater than our findings (2).

As far western countries are concerned, according to a recent data, from 2003-2012 the overall prevalence of Metabolic Syndrome in the United states was reported to be 33%(16) and the similar results were also found by Fernandez et al among adult Spanish population(17). A prevalence study on adult Chinese population concluded the age standardised prevalence rate was 21.3 % (18). The relatively low prevalence of our study could be attributed to the life style patterns and socio-economic /cultural factors, as major proportion of the Ranchi population is contributed by the Tribal population.

Females (23%, n=17/74) had higher rates of Metabolic Syndrome than males (18.8%, n= 18/96), though the difference was not statistically significant. Our study findings are comparable with the findings of Prasad et al (2),who observed significantly higher prevalence among females(52.2%) than males(34.2%).Study results from Chennai by Ramchandran et al showed presence of Metabolic syndrome 36.4% among men and 46.5% among women.(19). Similar study results were observed by Sidorenkov O et al on Northwest Russian population (20).Many studies in Indian subcontinent had shown, women had a higher prevalence of Metabolic syndrome (21, 22).A little

difference among men (24.0%) and women (23.4%) observed in NHANES III data (23). But there are some studies in India which show greater prevalence among males than females (24). In the present study, a higher prevalence among women could be understood by the facts that the majority of the population belong to middle socio economic group and most of the women were housewives. Their life styles are mostly inactive. Dallongerville et al suggested that elevated body weight and waist girth and the low HDL are significantly larger contributors to the metabolic syndrome in women than men.(25).

The present study also showed that there was an increase in prevalence with the increasing age. Maximum Prevalence was observed in subjects above 51 years (63.2%) and minimum in the age group 18-30 years (0.6%). This finding is in conformity with Ford ES et al who found an increase in prevalence of the Metabolic syndrome among US adults.(26). They found that the prevalence was increased from 6.7% among people aged 20-29 years to 43.5% for participants aged 60-69 years. This trend was also supported by another study by Ervin RB et al which showed about 20% of males and 16% of the females under 40 years of age met the criteria and 52% of males and 54% of females 60 years or above met the criteria for Metabolic syndrome. (27).The higher prevalence in the older age group is obvious as the number of the risk factors increases with age. Similar studies were obtained by Carnethon et al who suggested that young adults are at a reduced risk of developing Metabolic syndrome due to maintained regular physical activity (28).

In our study the prevalence of Metabolic Syndrome was very high in high socioeconomic group (55%, 14/25).The prevalence was 5.8 % (2/34) and 17.1 % (19/111) in low socioeconomic group and middle socioeconomic group respectively. The difference was statistically significant ($p=0.01$).Our results are found to be in conformation with the findings obtained by Prasad et al in urban eastern population, where he observed significantly high prevalence (47.8%) in high socio economic strata (2).Similar results were also obtained by Deepa R et al from Chennai showing 18.7% prevalence of Metabolic syndrome in upper socioeconomic strata and 6.5% in low socioeconomic strata (29). The high prevalence among high and middle socio economic group can be attributed to their dietary habits and life style. Dietary consumption of high saturated fats and cholesterol along with low in fibres and antioxidants puts them at risk of developing Metabolic syndrome. Besides this maladaptation, stressful life, alcoholism and smoking are additional contributory factors.

The results obtained in Ranchi are quite understandable as middle and high socioeconomic group here are undergoing a cultural transition which includes westernization of lifestyle and diet in addition to new addictions and professional stress. But this trend in India is different from western countries as reflected by study done by Carnethon et al in US population.(28).In India the prevalence of risk factors like obesity and dyslipidemia are more frequent in higher socioeconomic group where as in the US they are more frequent in lower socioeconomic groups. Analysis based upon food habits showed prevalence among vegetarians and non-vegetarians were 19.2% and 21.2% respectively. The difference was not statistically significant ($p=0.90$).The equally high prevalence among vegetarians can be attributed to their food habits which are full of sugars and refined carbohydrates.

The prevalence of Metabolic syndrome was highest (29.5%) in sedentary life style group whereas prevalence was least (10.5%) in active life style group. In the present study the difference was statistically significant ($p=0.002$).The reason is obvious as physical activity helps in reducing weight and maintaining a lower body mass index. Our study results are supported by result findings of Carnethon et al (28).

Various clinical parameters used to diagnose Metabolic Syndrome like Hypertension, Impaired glucose tolerance, Serum triglyceride level, Serum HDL-Cholesterol level and obesity also measured. The prevalence of Metabolic syndrome among subjects with hypertension was 75.5%, with impaired glucose tolerance was 70.1%, with raised level of serum triglyceride was 85%, with low HDL-Cholesterol was 73.2% and among obese was 91.2%.The study of these parameters was done to understand the predisposing risk factors and etiopathogenesis of Metabolic syndrome as it is crucial for guiding effective strategies for prevention and treatment of Metabolic Syndrome.

Conclusion:-

Our study suggested, a high prevalence (20.6%) of Metabolic syndrome in Ranchi that means one out of every five adults in Ranchi is at risk of developing type 2 diabetes mellitus and cardiovascular disease. Women are equally as prone as men. The study also revealed an increase in prevalence of Metabolic Syndrome with the increasing age. Highest prevalence was observed in the age group above 51 years suggesting that this group has increased risk of developing Type2 diabetes and cardiovascular disease.

Highest prevalence was observed among high socioeconomic group which could be attributed to the dietary habits and the sedentary life style group also had maximum prevalence due to less physical activity. The subjects with Hypertension, raised level of serum triglyceride, low level of serum HDL-Cholesterol and obese had high prevalence as these clinical parameters contribute to the development of Metabolic Syndrome.

According to our study a high prevalence of Metabolic Syndrome was found, so an early identification and preventive actions should be planned to prevent the occurrence of Metabolic Syndrome among individuals at risk. Strength of our study includes a well characterised study population and standardized techniques to measure various parameters of the study and a small sample size from the local area was included, which was the only limitation of our study. It was hospital based study so large prospective follow up studies covering wide geographical area should be undertaken to validate the findings.

Conflict of Interest:-

No conflict of interest to declare.

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