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Metabolic Syndrome – A Dentrimental Predictor of Prognostic Outcome in Heart Failure of Middle Aged Individuals

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Abstract:-

➢ ***Background:***

Heart failure and metabolic syndrome do not have well-established prognoses.It symbolizes a wide range of cardiac diseases, all of which might advance at varying rates. In terms of mortality and morbidity, this study assesses the prognosis of heart failure in middle-aged patients with metabolic syndrome. The current study involved 100 patients (60 with metabolic syndrome and 40 without), who were randomly chosen and had moderate to severe heart failure symptoms along with an ejection fraction of equal to or less than 40% and QRS duration of 130 seconds or more. The patients underwent standard heart failure treatment and underwent 24-week rounds of monitoring. The distance walked in 6 minutes and the NYHA class served as the key endpoints, The distance covered in 6 minutes and NYHA class served as the primary end criteria, with LVEF, LVEDD, and QRS duration serving as the supplementary end points. Conclusion: When compared to patients without metabolic syndrome, those with moderate to severe heart failure show less improvement in their condition. Patients with metabolic syndrome experienced a decrease in the distance walked in 6 minutes (336.40 16.0 Vs 285.35 3.30), an improvement in their functional NYHA class (75% Vs 33.3%), and an increase in their LVEF (35.22 1.7 Vs 31.63 2.74).

Keywords:- *Prognosis of Heart Failure, Metabolic Syndrome, LVEDD, LVEF*

I. INTRODUCTION

The term "metabolic syndrome" (also known as "Syndrome X" or "insulin resistance syndrome") refers to a collection of metabolic disorders that raise the risk of developing diabetes and cardiovascular disease.

➢ *Three of the following Criteria, as Stated by the NCEP ATP III Definition of the Metabolic Syndrome, Must be Met.*

- *Fasting plasma glucose > 6.1 m.mol/l (110 mg/dl)*
- *Blood pressure ≥ 130 / 85 mm Hg*
- *Triglycerides ≥ 1.7 m.mol/l (150 mg/dl)*
- *HDL < 1.04 m.mol/l (40 ml/dl) for men and < 50 mg/dl for women.*
- *BMI > 29.40 Kg/mm2 or waist circumference > 102 cm (men), > 85 cm (female).*

➢ *Need for the Study:*

The prognosis of HF in the presence of the metabolic syndrome is not well understood as:

- *It symbolizes a wide range of cardiac diseases, all of which develop at various speeds.*
- *The disease's development could be sneaky, and the prognosis as a whole is yet unknown.*

Data indicates that the prognosis is generally bad once the patient exhibits symptoms, with a 20% annual mortality rate.

➢ *Prevalence :*

In males and women, the age-standardized prevalence of metabolic syndrome was 13.7 and 14.2, respectively. Age-adjusted estimates from the third National Health and Nutrition Examination Survey (1988-1994) suggest that 80% of people with type 2 diabetes and 23.7% of adults in the USA had metabolic syndrome. Utilizing modified Asian criteria for abdominal obesity considerably raised the prevalence of metabolic syndrome in the Asian population, which was lower than that of the US and European populations. The term "metabolically obese" or, more accurately, "dysfunctional" can be used to describe South Asians. They are, thus, "non-obese by conventional BMI standards" despite having multiple metabolic abnormalities.

➢ *Definition of Metabolic Syndrome :*

Three of the following criteria were met, according to the NCEP ATP III definition of metabolic syndrome.

- *6.1 mmol/l (110 mg/dl) or higher in fasting plasma glucose*
- *Blood pressure less than 130/85 mm Hg.*

- *Triglycerides: 1.7 mmol/l (150 mg/dl) or less*
- *High density lipoprotein cholesterol: 40 ml/dl for men and 50 mg/dl for women, at a level of 1.04 mmol/l.*
- *A BMI of greater than 29.40 kg/mm2 or a waist measurement of more than 102 cm for men or 85 cm for women*

Asian Indian migrants in Singapore and those from Asia who had recently migrated to India were researched using a modified definition of the metabolic syndrome that included revised cut-off points for waist circumference. The South East Asian definition adds three new criteria, including modified waist circumference cut-off points (> 90 cm for men and > 80 cm for women) and modified body mass index cut-off points (> 23 kg/m2).

II. METABOLIC SYNDROME AND RISK OF HEART FAILURE

A higher risk of HF in the future exists in the presence of metabolic syndrome. In addition to the known risk factors for HF, the metabolic syndrome offers critical risk information. Given that insulin resistance has been linked to both left ventricular systolic and diastolic dysfunction as well as left ventricular remodeling, insulin resistance—and its clinical proxy, metabolic syndrome—may have direct cardiac effects in addition to atherogenetic consequences. In the absence of diabetes, the relative risk for newly developing coronary vascular disease is typically 1.5 to 3 times higher in people with the metabolic syndrome. In the Framingham off-spring study (FOS), which followed middle-aged men and women for 8 years, the population attributable risk for patients with the metabolic syndrome to develop coronary vascular disease was 34% in men and 16% in women..

➢ *Diabetes Mellitus and Heart Failure*

A higher risk of heart failure is linked to diabetes. Data from the Framingham research show that diabetes males had a higher incidence of heart failure than non-diabetics by more than twice. Women with diabetes had a five-fold increased risk of cardiomyopathy, according to research. Diabetes is a complicated ailment, and the disease's several interrelated symptoms all work together to cause diabetic cardiomyopathy. Each of these characteristics has a variety of functional effects that can occur, and in most patients, more than one of these effects is present.

Numerous probable direct consequences on the myocardium from the role of hyperglycemia in the metabolic syndrome are linked to insulin resistance and the associated hyperinsulinemia. First of all, the myocardium may respond to insulin as a growth factor. Second, heart failure is caused by the sympathetic nervous system being activated by hyperinsulinaemia. Thirdly, it has recently been demonstrated that insulin resistance heightens the trophic effect of angiotensin II on cellular hypertrophy and collagen production in hypertensive individuals, which results in cardiac hypertrophy and fibrosis, two important precursors to heart failure.

➢ *Hypertension and Heart Failure*

First National Health and Nutrition Examination Survey results show that hypertension patients, regardless of age, had a 40% higher chance of having heart failure than non-hypertensive patients. The Framingham Heart Study shows that after age 40, persons with blood pressure of 160/100 have a twice as high lifetime chance of having heart failure as those with blood pressure of 140/90, and this risk is increased by CAD, DM, and LVH 41. Heart failure may occur as a result of hypertension, either through promoting coronary artery disease or by stimulating LVH 42. It has been proposed that stiffness of the central aorta, increased pulsatile bed, and altered vascular ventricular function may all increase the likelihood of subsequently developing heart failure. It has been proposed that stiffening of the central aorta, increased pulsatile bed, and altered vascular ventricular coupling may also play a significant role in heart failure because systolic pressure and pulse pressure appear to have a greater impact on risk of subsequent heart failure than the diastolic pressure.

➢ *Metabolic Syndrome and Inflammation*

There is strong evidence that the metabolic syndrome and inflammation are related. Tumor necrosis factor and IL-1 are examples of inflammatory cytokines that may be involved in the gradual cardiac remodeling that takes place in heart failure. These molecules' main function is to start the healing process for damaged myocardium. These compounds are sufficient to cause harmful alterations in cardiac myocytes and the extracellular matrix of the myocardium when expressed for extended periods of time. In individuals with heart failure, circulating levels of pro-inflammatory cytokines such as tumor necrosis factor and IL-6 are elevated and are associated with a poor result.

III. METHODOLOGY

A total of 100 heart failure cases—both those with and without metabolic syndrome—were included in this cross-sectional investigation. All patients underwent thorough clinical examinations and research. The study includes patients who have metabolic syndrome as well as those who do not. No of their sex, the patients were chosen at random.

All cases were selected on the basis of :

➢ *Clinical Signs and Symptoms* –
Paroxysmal Nocturnal Dyspnea

- *Nocturnal cough*
- *Dyspnoea on Exertion*
- *Ankle Edema,*
- *Weight gain > 4.5 kg*
- *Decrease in urinary output*
- *Palpitations*
- *Wheeze*

➢ *On Examination*

- *Neck Vein Distension*
- *Pitting type pedal edema*

- *HR : 90 – 140 / min*
- *Increased JVP.*
- *Hepato – Jugular reflex*
- *Respiratory : Basal crackles*
- *Cardio Vascular : Cardiomegaly*
- *S3 gallop, Murmur*
- *P/A : Hepato Megaly*

➢ *Radiological Findings*

- *Chest x-Ray Alveolar pulmonary edema Interstitial pulmonary edema B/L Pleural Effusion. Cardio thoracic ratio > 0.5 Cardiomegaly*
- *Echo : Heart failure with EF ≤ 40 LVEDD mm Systolic dysfunction.*
- *ECG : QRS interval more than 130 ms.*

➢ *Hematological Examination for :*

Hb, ESR, Renal function Liver function test CRP Complete lipid profile HBA1c, FBS and patients are grouped into metabolic syndrome and without metabolic syndrome.

➢ *Follow up of the Cases :*

Prior to beginning HF treatment, a thorough history and clinical examination were performed. Patients who met the requirements initially underwent the following assessments. 6-minute walking test, 2-dimensional echo, and QRS interval in the NYHA class. After randomization, baseline characteristics were reevaluated after one, three, and six months. NYHA and the distance covered in 6 meters were the study's two primary end measures, and LVEF%, LVE diastolic dimension (mm), QRS length (ms), and a clinical composite response, which categorizes the patients into one of the three response groups, were its three secondary end points. As it Got Worse, It Didn't Change Additionally, the death rate was taken into account.

➢ *Inclusion Criteria:*

- According to the NCEP criteria, 60 patients with metabolic syndrome and moderate to severe heart failure symptoms in middle age (40-60 years) with a waist circumference instead of a BMI linked with an ejection fraction of under 40% and a QRS length more than 130 ms..
- With an LVEF 40% and a QRS length greater than 130 ms, 40 individuals with heart failure in middle age without metabolic syndrome were examined.

➢ *Exclusion Criteria*

- *Valvular disease together with heart failure*
- *Rheumatic heart disease and cardiac failure*
- *Patients who have pacemakers*
- *Patients with liver cirrhosis and renal failure*
- *Patients having a Heart Rate > 140 and an SBP 80 mm Hg*
- *People who have hypothyroidism. systolic functional characteristics are evaluated*

IV. RESULTS AND OBSERVATIONS

➢ *Age Wise Distribution Of Cases*

Table 1 Age Wise Distribution of Cases

Age group	HF with Metabolic syndrome	Percentage	HF without Metabolic syndrome	Percentage
40-45	5	8.3%	3	7.5%
46-50	8	13.4%	8	20%
51-55	26	43.30%	09	22.5%
56-60	21	35%	20	50.0%
Total	**60**	**100.00%**	**40**	**100.00%**

Heart failure is more common as people age, both in those with metabolic syndrome and those without it. The highest incidence, or 43.30% of the incidence, was seen in people with metabolic syndrome between the ages of 51 and 55, while 50% of the incidence was seen in people without metabolic syndrome between the ages of 56 and 60.

➢ *Sex Wise Distribution Of Cases:*

Table 2 Sex Wise Distribution of Cases

	0	Percentage	HF without Metabolic syndrome	Percentage
Male	26	43.3%	23	57.50%
Female	34	56.6%	17	42.50%
Total	**60**	**100.00%**	**40**	**100.00%**

In the present study, in metabolic syndrome group 43.30% are males and 56.60% are females whereas, in patients without metabolic syndrome group 57.50% are males and 42.50% are females.

➢ *Categorization of Patient on each follow up*

Table 3 Categorization of Patient

Time	Improved				Unchanged				Worsened			
	HF with MS	%	HF without MS	%	HF with MS	%	HF without MS	%	HF with MS	%	HF without MS	%
1 Month	20	31.3%	28	60%	19	31.6%	8	20.0%	16	26.6%	1	2.5%
3 Months	26	43.3%	30	75%	16	26.6%	6	15.0%	12	20.0%	2	5.0%
6 Months	30	50.0%	30	75%	13	21.6%	5	12.5%	8	13.3%	1	2.5%

In the current study, after a 4-week follow-up, out of 60 patients with HF and metabolic syndrome, 31.3% showed improvement, 31.6% remained constant, and 20% showed worsening.By the time 4 weeks had passed, 60% of patients with HF without metabolic syndrome had improved, 20% had remained stable, and 2.5% had gotten worse. Following a 12-week follow-up, the metabolic syndrome group saw a 43.3% improvement, a 26.6% hold-stable, and a 20% worsening. Compared to people without metabolic syndrome, who saw a 75% improvement rate, a 15% hold steady rate, and a 5.0% worsening rate. After a follow-up of 24 weeks, patients with metabolic syndrome showed a 50% improvement, a 21.6% stagnation, and a 13.3% worsening, while individuals without metabolic syndrome showed a 75% improvement, a 12.5% stagnation, and a 2.5% worsening.

➢ *Effect on Primary end Points 4) Improvement / Change in Nyha Class - 24 Weeks follow Up.*

Table 4 Effect on Primary end Points 4) Improvement / Change in Nyha Class - 24 Weeks

	HF with Metabolic syndrome	Percentage	HF without Metabolic syndrome	Percentage
Improvement by 2 class	21	35.0%	31	77.5%
Improvement by 1 class	9	15.0%	-	-
No change	12	20.0%	4	10.0%
Worsened	8	13.3%	1	2.5%

By the end of the 24-week follow-up, 33.3% of patients with metabolic syndrome had changed their NYHA class to be greater than two, compared to 75% of patients without metabolic syndrome. While there are no individuals without metabolic syndrome, the total number of patients improved by class-1 15%. 21.67% of patients with metabolic syndrome and 12.5% of individuals without it show no change in NYHA class. While individuals without metabolic syndrome made up 2.5% of the NYHA class, those with it made up 13.3%.

➢ *Change in the Distance Walked in 6 Minutes.*

Table 5 Change in the Distance Walked in 6 Minutes

Time	HF with Metabolic Syndrome		HF without Metabolic Syndrome		T	P	Remarks
	Mean	SD	Mean	SD			
On admission	-	-	-	-	-	-	-
1 months	262.24	± 34.10	311.78	± 5.7	3.3	<0.002	Highly significant
3 months	211.61	± 33.22	324.39	± 11.91	3.6	<0.002	Highly Significant
6 months	285.35	± 3.30	336.40	± 16.0	3.3	<0.002	Highly Significant

The distance walked in 6 minutes after a 4-week follow-up was determined in the current investigation, and at a P value 0.002, it was shown to be significantly greater than the table T value. This difference persisted at the 3- and 6-month follow-ups. Therefore, there is a very significant improvement in the distance walked in 6 minutes at each follow-up for patients without metabolic syndrome compared to those with metabolic syndrome.

➢ *Changes in the QRS Duration.*

Table 6 Changes in the QRS Duration

Time	HF with Metabolic Syndrome		HF without Metabolic Syndrome		T	P	Remarks
	Mean	SD	Mean	SD			
On admission	146.97	± 4.66	142.03	±4.11	1.947	<0.052	Not Significant
1 months	145.23	± 5.06	141.11	± 2.26	1.821	<0.070	Not significant

3 months	144.95	± 5.18	139.11	± 2.36	2.513	<0.012	Highly Significant
6 months	143.92	± 6.07	138.00	± 2.03	2.266	<0.024	Highly Significant

In this study, there was no significant difference in QRS length between patients with and without metabolic syndrome at the time of admission, with T computed at 1.947 compared to T in the table at P 0.052. After a 4-week follow-up, T calculated at 1.821 compared to T's table value at P 0.070 revealed no discernible difference in the QRS length between individuals with and without metabolic syndrome. After a 12-week follow-up, patients without metabolic syndrome showed a highly significant reduction in the length of the QRS, as measured by T computed at 2.513 compared to T's table value at P value 0.012. At T calculated 2.266 compared with table value of T at P value 0.024, it was shown that individuals without metabolic syndrome had a highly significant decrease in the QRS duration after 24 weeks of follow-up.

➢ *Age Wise Distribution of Deaths*

Table 7 Age Wise Distribution of Deaths

Age Group	HF with Metabolic Syndrome	Percentage	HF without Metabolic syndrome	Percentage
40-45	-	-	-	-
46-50	2	3.3%	-	-
51-55	2	3.3%	1	2.5%
56-60	6	10.0 %	3	7.5%
Total	**10**	**16.60%**	**4**	**10%**

The mortality rates increases with age in both metabolic syndrome and patients without metabolic syndrome highest mortality noticed at 56 to 60 years age group.

➢ *Sex Wise Distribution of Deaths*

Table 8 Sex Wise Distribution of Deaths

Sex	HF with Metabolic Syndrome	Percentage	HF without Metabolic syndrome	Percentage
Male	3	5%	2	5%
Female	7	11.6%	2	5%
Total	**10**	**16.50%**	**4**	**10%**

In the present study , metabolic syndrome group females having more deaths than male while in patients without metabolic syndrome both male and female have equal percentage of deaths.

V. CONCLUSION

The prognosis of heart failure in metabolic syndrome is retrieved with reference to age, sex, NYHA improvement, distance walked in 6 minutes, LVEF, LVEDD, and QRS length. The prognosis for people with metabolic syndrome is generally poor once symptoms appear, with a mortality rate of 16.6% and morbidity, or the frequency of hospitalizations or usage of intravenous drugs, being significant, at 50%. Heart failure and metabolic syndrome are both associated with significant morbidity, which lowers quality of life by limiting daily living activities.

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