Association of NTproBNP in metabolic syndrome

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Abstract---Aim: The association between NTpro BNP values and different biochemical and anthropometric parameters of metabolic syndrome patients and non-metabolic syndrome individuals are correlated here. Methods: The research involved 200 people aged 21 to 60 years old (100 control and 100 cases). The following measurements were taken- FBS, SBP, DBP, BMI, and lipid profile. Using multiple regression, we examined the correlation between NTproBNP and metabolic syndrome and non-metabolic syndrome patients. Correlation of Metabolic syndrome parameters with NTproBNP values are done. Result: NT pro BNP values are higher in metabolic syndrome patients in comparison to non-Metabolic syndrome patients. NTproBNP values are positively correlated with SBP, TG, LDL values in metabolic syndrome patients. Conclusion: NT pro BNP values are higher in metabolic syndrome patients in comparison to non-Metabolic syndrome patients.

Keywords---BMI, Metabolic syndrome, NT-pro BNP, SBP, DBP.

1. Introduction

As a global health issue, the metabolic syndrome is a group of risk factors for coronary heart disease (CHD) that include excessive weight, abnormal glucose, and lipid metabolism, as well as hypertension. Due to a reduction in physical activity and an increase in obesity in our culture, the burden of metabolic syndrome will continue to climb [1-4].

Decreased levels of NT-proBNP, a cardiac hormone that has been identified as a novel and important biochemical marker for the diagnosis and elucidation of congestive heart failure, are linked to obesity. Despite the well-established link between elevated NT-proBNP levels and obesity, there is conflicting evidence about the link with other metabolic risk factors. For this reason, the association between BMI and the prevalence of cardiovascular disease has been proposed to indicate a "natriuretic handicap," with a diminished reaction of the heart's walls under stress, which contributes to the onset and development of cardiovascular disease [5–7]. Although NTproBNP plasma levels in obese persons are still predictive of heart failure risk, lower thresholds are required to achieve the same degree of accuracy as in normal weight people [8–10]. A surprising finding is that low natriuretic peptides levels have been linked to an increased risk of diabetes occurrence in population-based studies [12–14], and that natriuretic peptide levels and insulin sensitivity are inversely related [15–17]. Overweight and obese patients had higher circulating levels of natriuretic peptides than those with cardiovascular disease after losing weight or undergoing bariatric surgery.

Natriuretic peptides may have a role in the expansion of insulin resistance in conditions such as the metabolic syndrome, diabetes, and overweight or obesity [18]. The link among metabolic syndrome and natriuretic peptides is gaining interest, with research pointing to both higher as well as lower levels [19–22]. For those with no known cardiovascular disease, NTproBNP has been shown to be the most accurate predictor of mortality from cardiovascular causes [23]. Insulin-resistant diseases have been linked to an expanded risk of metabolic and cardiovascular disease, while the existence of subclinical CVD has been linked to a decrease in natriuretic peptide levels [24,25]. However, NTproBNP readings remain insufficient. Because of the small number of patients studied and limited generalizability of the results, clinical research may be biased by the small sample size and lack of investigations comparing the levels of plasma NTproBNP in diabetic and non-diabetic populations. The association between various components of metabolic syndrome and NT-proBNP was investigated in this research.

2. Material and Methods
2.1 Participants and diagnostic criteria

Patients recruited from medicine OPD SLN MCH Koraput. Patient consent forms are signed. Body weight, height and waist circumference was measured. SBP and DBP are measured using sphygmomanometer. 5ml blood are withdrawn from patients for routine parameters (FBS, LIPID profile, urea) and NTproBNP Metabolic syndrome patients were diagnosed from the widely accepted guidelines of National Cholesterol Education Program's Adult Treatment Panel III (ATP III),

the American Heart Association/ National Heart Lung and Blood Institute (Harmonization) and the International Diabetes Federation (IDF). Presence of any three of the following five conditions is essential as shown below.

1. Increased waist circumference (males: ≥90 cm and for females: ≥80 cm).
2. Hypertriglyceridemia ≥150 mg/dl (1.7 mmol/l).
3. Low HDL (Males <40 mg/dl (1 mmol/l) and for females <50 mg/dl (1.3 mmol/l).
4. Elevated blood pressure (systolic blood pressure ≥130 mmHg and/or diastolic blood pressure ≥85 mmHg or drug treatment for hypertension).
5. Elevated blood sugar (fasting blood sugar ≥100 mg/ dl (5.6 mmol/l) or drug treatment for diabetes
   mellitus).

2.2 Case and Control group

MetS patients are included in the case group. Patients coming for routine health checkup mainly are recruited in control group those are metabolically healthy depending on the blood reports satisfying none of the criteria of metabolic syndrome guidelines. Women under the age of 20 and those who were pregnant were excluded from the study. People with a history of heart failure or renal illness were also barred from participating. Each patient who came to the hospital underwent a basic physical examination, which included measurements of waist circumference, height, weight, and hip circumference (to the nearest 0.1 cm). By multiplying the square of one's height in meters squared with one's weight in kilograms, the BMI was computed (m^2). During this time, the subjects were advised to sit down and abstain from conversing. At least one minute between each successive measurement, an automated blood pressure monitor was used to measure blood pressure and heart rate (OMRON Corporation). There were three readings collected for this study. This research was approved by the institutional review board, and all participants gave their consent after being informed.

A variety of demographic and anthropometric data were collected. A series of biochemical assays, including glucose and lipid profiles, were carried out on the blood of those who had fasted. EM 360 was used to assess the blood biochemical parameters and NT Pro BNP was assessed by ELISA. The CV ranged from 2.2 to 5.8 percent in the low and high NTproBNP scales, with intra-assay variance less than 3.0 percent.

2.3 Statistical analysis

For statistical analysis, we utilized the SPSS software version 25. The mean and standard deviation (SD) were used to characterize continuous variables. The comparison and association between specific metabolic syndrome components and NT-proBNP was identified using the student's two-tailed T-test and correlation.

3. Result

The comparison of various parameters between metabolic syndrome patients with non-metabolic syndrome patients were depicted in table 1. A paired sample T-test

was conducted to carry out the comparison between the groups. The data indicated statistically high significant result between patients with metabolic syndrome with non-metabolic syndrome patients (P ≤ 0.05).

Table 1. Paired Samples Test between various parameters in control and the experimental group

	Paired Differences							Sig. (2-tailed)
		Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
	Mean			Lower	Upper	t	df	
BMI	-11.7653	6.85851	0.68585	-13.1262	-10.4044	-17.154	99	0.000
FBS	-67.2150	50.94299	5.09430	-77.32319	-57.10681	-13.194	99	0.000
SBP	-24.8	16.62783	1.66278	-28.0993	-21.5007	-14.915	99	0.000
DBP	-17.9	69.08398	6.9084	-31.6078	-4.19224	-2.591	99	0.011
HDL	6.602	8.98871	0.89887	4.81844	8.38556	7.345	99	0.000
LDL	-49.23	21.53192	2.15319	-53.5024	-44.9576	-22.864	99	0.000
TG	-168.16	136.7814	13.67814	-195.3	-141.02	-12.294	99	0.000
NT Pro BNP	-404.68	39.45202	3.9452	-412.508	-396.852	-102.575	99	0.000

- Correlation between NT-Pro BNP, BMI, SBP, FBS, TG, LDL and HDL in experimental group
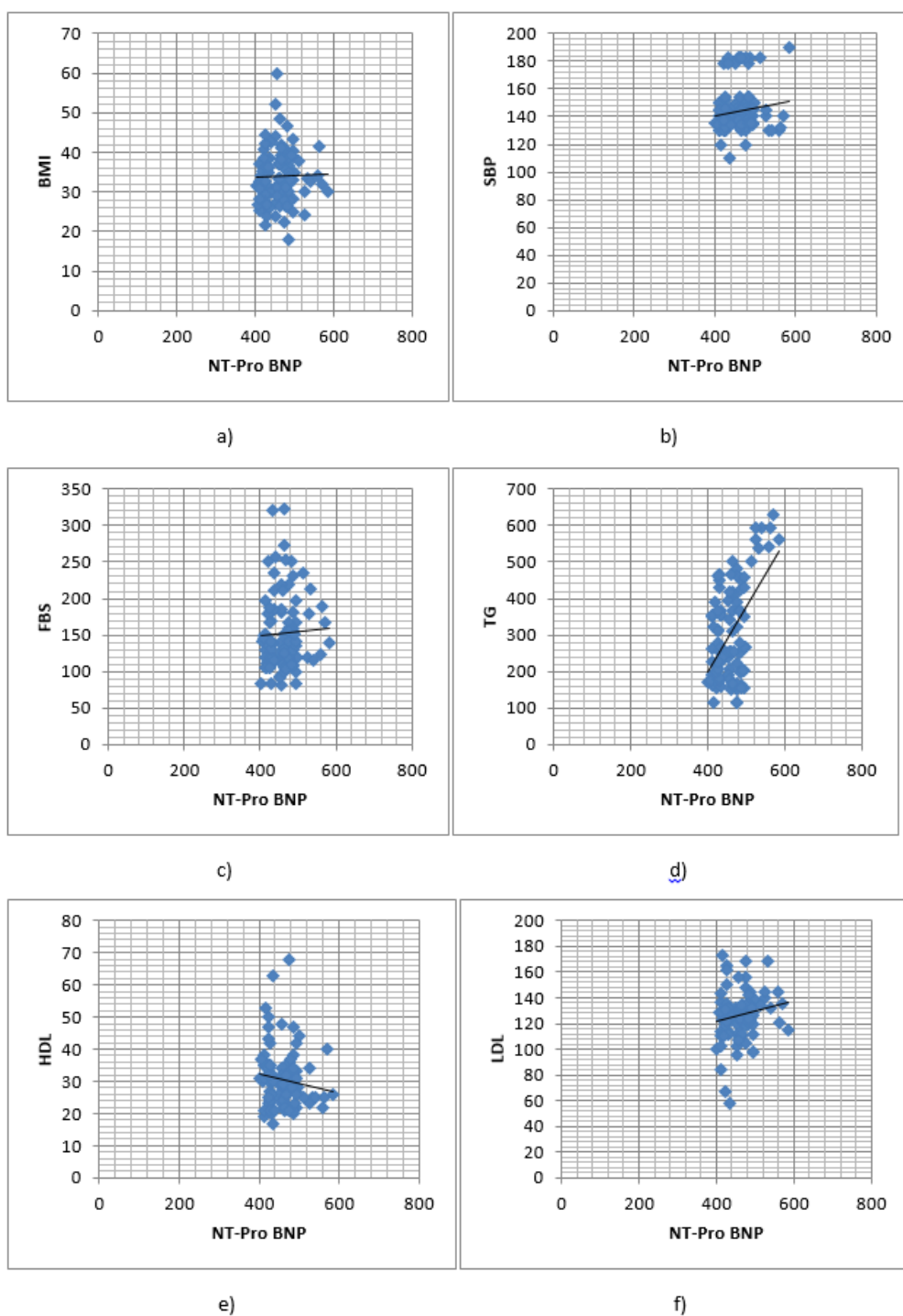
Figure 1. Correlation between a) NT-Pro BNP and BMI, b) NT-Pro BNP and SBP, c) NT-Pro BNP and FBS and d) NT-Pro BNP and TG, e) NT-Pro BNP and LDL and f) NT-Pro BNP and HDL

Figure 1 depicts the correlation between NT-Pro BNP and the experimental group's BMI, SBP, FBS, TG, LDL, and HDL cholesterol levels. The data indicated positive correlation between NT-Pro BNP and BMI, FBS, SBP, DBP, and LDL, with statistically no significant relation between them (r=0.028; P=0.785; r=0.049; P=0.627; r=0.135; P=0.182; r=0.082; P=0.419 and r=0.179; P=0.075 respectively) whereas NT-Pro BNP showed highly significant correlation (r=0.529, P=0.000). However, HDL showed negative and non-significant correlation with NT-Pro BNP (r=-0.126, P=0.212).

4. Discussion

In a large population-based cohort of metabolic syndrome and non-metabolic syndrome patients, study examined at the cross-sectional link between NTproBNP and insulin-resistance-related diseases including metabolic syndrome. In our study, NT-Pro BNP, BMI, SBP, FBS, TG, LDL, and HDL indicated statistically a highly significant difference among the non-metabolic and the metabolic patients (P < 0.05). It also showed a positive correlation between NT-Pro BNP and SBP, BMI, FBS, DBP, LDL and TG, but there was no significant relation among them (r=0.028; P=0.785; r=0.049; P=0.627; r=0.135; P=0.182; r=0.082; P=0.419 and r=0.179; P=0.075 respectively). TG on the other hand shows highly significant correlation with NT-Pro BNP (r=0.529, P= 0.000). However, HDL showed negative correlation (r=-0.126, P=0.212), with statistically no significant relation between them (P ≥ 0.05). Thus, NTpro BNP values are higher in metabolic syndrome patients in comparison to non-metabolic syndrome patients.

BNP and N-terminal pro-atrial natriuretic peptide plasma levels were linked to metabolic risk variables in 3333 adults in the Framingham study without heart failure [26]. SBP and HDL-C were favorably linked with BNP, whereas BMI, DBP, total cholesterol, fasting glucose, and insulin resistance were adversely associated with BNP. BNP was also negatively associated with insulin resistance. Large-scale Danish research by Olsen et al [20] found comparable results [19]. MetS patients' NT-proBNP levels did not rise significantly in comparison to those of the same age and sex in the study by Sezen et al [27]. Our findings agreed with theirs. After controlling for age, gender, body height, our research found that MetS was linked with serum NT-proBNP levels. In prior investigations, a careful matching technique was seldom used. The delicate balancing act between potential variables revealed the connection between MetS and NT-proBNP.

According to previous research, the natriuretic system and obesity are connected [28]. Adipose tissue has a high concentration of natriuretic peptide clearance receptors, which suggests that adipocytes are involved in the removal of natriuretic peptides from the blood. A lower natriuretic peptide concentration may result from higher clearance of natriuretic peptide in obese people. As well as this, in isolated human fat cells and adipocytes, natriuretic peptides exhibit significant lipolytic actions, which are activated by the chemical messenger cyclic guanosine monophosphate (cGMP) [29]. This might lead to an increased buildup of fat in the body's tissues, including the adipose tissue and the muscle, and therefore maintain the obesity condition. Previous studies have shown an inverse connection between NT-proBNP and obesity (p=0.018), which is consistent with the findings of the current investigation [20]. Weight and BMI (r=0.583, p=0.001

in both; r=0.480 in the MetS participants and non-MetS subjects) are substantially associated (p=0.001 in both). The model still demonstrated that BMI is the factor that is associated with NTproBNP, rather than waist circumference. Moreover, this is in line with results from previous research. If this is true, it suggests that the quantity of adipose tissue in the abdomen is not representative of the total body fat.

Studies have shown that plasma NT-proBNP is positively correlated with HDL-C, but negatively correlated with total cholesterol and triglycerides [26]. There was no association between plasma BNP and total cholesterol or HDL-C in a Japanese study [30]. HDL-C had no effect on NT-proBNP in our matched study. In the MetS group, NTproBNP was, on the other hand, positively correlated with HDL-C. Natriuretic peptide and cholesterol or triglyceride may not have a direct causal link. A decreased natriuretic peptide signaling could lead to visceral adiposity, which is associated with dyslipidemia, and increase the risk of cardiovascular disease.

In Wang's research, plasma natriuretic peptide levels were shown to be negatively associated to all MetS components except for high blood pressure and low HDL-C [26]. Higher BNP levels were not found to be linked with other metabolic variables in this investigation. They are diuretic and have diuretic, natriuretic, and vasodilatory effects. Blood pressure's hemodynamic impact on natriuretic peptide production might explain why BNP levels correlate differently with blood pressure than with other components of the metabolic syndrome. However, it also suggests that blood pressure and other metabolic parameters may have separate pathophysiological drivers [31]. We've shown in earlier structural equation model research that obesity has a significant impact on blood pressure without the involvement of inflammation or insulin resistance [32].

The correlation between BNP and fasting glucose is ambiguous. A connection was identified between fasting glucose and NT-proBNP that was negative, according to Olsen et al [20]. Sezen et al. [27] and the current investigation failed to find this. Our investigation and that of Olsen et al. showed a strong correlation between insulin levels and NTproBNP levels.

Triglyceride/decreased HDL-C and NT-proBNP levels were shown to have a comparable influence on metabolic variables and inflammatory factors when combined. Because obesity causes inflammation, insulin, and dyslipidemia in a sequential manner that might explain these correlations [20]. To understand why MetS and NT-proBNP levels seem to be inconsistent, it may assist to understand the separate pathways of obesity to vasopressors and metabolic/inflammatory variables.

5. Conclusion

It can be concluded that NT-proBNP levels were affected in a number of different ways by cholesterol, blood pressure, and fasting blood sugar. Due to the fact that the effects of each component were related to one another, metabolic syndrome as a whole was associated with NT-proBNP. The changes in these parameters will affect the levels of NT-Pro BNP indicating higher chances of cardiovascular

diseases. It is important to consider these metabolic parameters, inflammatory indicators, and blood pressure components whenever we are attempting to evaluate the levels of natriuretic peptide for diagnostic or prognostic reasons.

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