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Evaluation of brain natriuretic peptide in patients with type 2 diabetes

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Abstract

The purpose of the current study was to use brain natriuretic peptide (BNP) as a biomarker to find a novel approach for identifying and forecasting atrial and ventricular pre-systole (PVS), a significant illness. Following a monthly check-up for patients with type 2 diabetes, the study was carried out at Al-Sadr Hospital clinics and private laboratories in the Najaf Governorate, Iraq, from September 1, 2024, to February 1, 2025. There were 90 patients in all, 60 of whom had PVS and 30 healthy controls. Age, type of PVS (atrial and ventricular), diagnosis (treated or newly diagnosed), length of disease, hypertension (hypertension or normotension), and body mass index (BMI) group were used to categorize the patients into subgroups. In comparison to the control group, the current results demonstrated a substantial rise ($P<0.05$) in BNP. There was a significant difference ($P<0.05$) between the male and female patient groups. The current findings also showed that the prevalence of ventricular arrhythmia was substantially ($P<0.05$) greater in older individuals (60–69 years) than in those who already had ventricular arrhythmia. The current findings showed a significant ($P<0.05$) difference in patients with newly identified ventricles. Additionally, the current study showed that the biomarker increased in the hypertension group in a very significant ($P<0.05$) way. The patient groups' sickness durations (from 1 week to 1 month) were substantially ($P<0.05$) longer than those of those aged 1–5 and >5 years. The prevalence of obesity was substantially greater ($P<0.05$) in the obese patient group compared to the overweight and normal weight groups based on BMI.

Keywords: Premature atrial contraction, sex, age.

Introduction

Diabetes is a major disease that affects cardiac function, such as skipped beats in both the atria and ventricles, occurring in a region other than the sinus node, leading to arrhythmias (1-3). Natriuretic peptide (NP) is a member of the polypeptide hormones secreted by cardiac muscle cells and plays an important role in regulating heart size and cardiovascular balance. Therefore, two types of NP can be distinguished: atrial natriuretic peptide (ANP) and brain natriuretic peptide (BNP). These two peptides are synthesized in both the atria and ventricles of the cardiac muscle (4, 5). Several so-called accessory cardiac sites, including the brain, gonads, and kidneys, are other sites of BNP synthesis (6). Many heart-related diseases lead to elevated BNP, such as ventricular dysfunction, atrial and ventricular fibrillation, and ischemic heart disease (7). The family of natriuretic peptides (BNPs) includes four subtypes that were first identified in teleost fish, called echinoderms: ANP, BNP, C-natriuretic peptide (CNP), and ventricular natriuretic peptide (VNP). Pro-BNP is a polypeptide of 108 amino acids encoded by genes on

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chromosome 1 and is a precursor to BNP, which consists of 32 amino acids and has a molecular weight of 3472 Daltons (8). The aim of this study was to investigate the biomarker profile to identify a new strategy for the diagnosis and prognosis of an important disease called atrial and ventricular premature contraction in diabetic patients using brain natriuretic peptides.

Materials and Methods

Subjects

The current study included sixty (60) type 2 diabetic patients with premature myocardial infarction and a control group (apparently healthy) of thirty (30). Patient samples were collected from patients visiting the Najaf Diabetes Center and private laboratories in Najaf Governorate during the period from 1/9/2024 to 1/2/2025. Patients were divided into several subgroups according to age, gender, atrial or ventricular status, diagnosis, disease duration, hypertension, and body mass index.

Inclusion criteria

The present study included type 2 diabetic patients with atrial and ventricular presystole of different ages and genders, newly diagnosed or treated, with different body mass index (normal, overweight, and obese), with hypertension or normotensive status, and with different disease durations.

Exclusion

Several criteria were excluded from the present study, such as heart failure and myocardial infarction, as well as other diseases, such as kidney failure, liver disorder, diabetes mellitus, and hematological disease.

Diagnosis

A physician and a visitation (doctor) diagnosed a patient according to an electrocardiogram to atrial and ventricular (Figure 3_1 and 3_2) with symptoms including pallor, difficult breathing, general weakness, chest pain, and difficulty in moving or walking.

Biomarkers assay

Brain natriuretic peptides (BNP)

Kits were supplied by Finecare, measuring by Finecare as catalog number (W825P0001)

Experimental design

The total number of patients included sixty (60), and the control thirty (30) patients were subdivided into several subgroups:

1-Atrial premature contraction patients as thirty (30), and ventricle premature thirty (30).

2-New and treated included new patients subgroups as twenty-five (25), and treated subgroups thirty-five (35).

3- Duration of disease (1 week-1 month) as twenty (20), (1-5 years) included twenty-five (25) and more than 5 years as fifteen (15).

4- Hypertensive subgroups included forty (40) and normotensive a twenty (20).

5- Body mass index included normal weight, twenty (20), overweight, fifteen (15), and obese, twenty-six (25).

6- According to sex, included males twenty-five (25) and females thirty-five (35).

7-According to age included (30-39) years as fifteen (15), (40-49) years old as ten (10), (50-59) years old as twenty (20), and (60-69) years as fifteen (15).

Statistical analysis

The data analysis was performed by SPSS version 20, where the t-test was used between patients and controls, and correlation was studied in this study.

Results

Brain Natriuretic Peptides (BNP)

Comparison between premature heart contraction patients and the control group

Figure 1 indicates a significant increase ($p< 0.0001$) in premature heart contraction patients (452.7± 21.11) in comparison with the control group (32.11 ±2.214).

Comparison of premature heart contraction patients in the BNP level according to sex.

The present results in Figure 2 revealed a significant difference (P< 0.0001) in males (741.9 ±50.31), higher than in females (264.2 ±20.49).

Comparison between premature heart contraction in (BNP) according to age.

The current study in figure (3) indicate a signification increase (P < 0.0001) in ages (60-69) years (895.1 5 ±7.35) in compare with age (50-59) years (476.4 ± 17.91),(40-49) years (280.8 ± 11.49) and (30-39) years (152.1 ± 6.784). Also, other age groups, 50-59 years, (40-49) years showed significant increases with age (30-39) years.

Comparison between the BNP level in premature heart contraction according to atrial and ventricular types.

Figure 4 revealed a significant increase (P<0.0001) in atrial premature contraction (703.4± 45.97) in comparison with ventricular (232.1± 17.03).

Comparison between the BNP level in premature heart contraction according to new and treated patients.

The results illustrated in Figure 5 show a significant increase (P<0.0001) in new diagnosis patients (720.3 ± 57.44) compared with treated (290.0 ± 23.56).

Comparison between the BNP level in premature heart contraction according to hypertension.

In Figure 6 documentation shows that significant increase (P<0.0001) in hypertensive patients (620.8 ± 43.01) compared with normotensive (176.7 ± 11.33).

Comparison between the BNP level in premature heart contraction according to the duration of the disease.

Figure 7 showed a significant increase (P<0.0001) in duration of disease (1 weak-1 month) (815.8 ± 53.09) in comparison with other durations (1-5) years (378.6 ±19.36) and (>5) years (152.0 ±6.888). The results also indicate a significant increase in duration of disease (1-5) years in comparison with (>5) years.

Comparison between BNP levels in premature heart contraction according to body mass index.

The present results in Figure 8 proved that a significant difference (P<0.0001) in obese patients (745.9 ± 49.76) in comparison with overweight (235.8 ± 24.38) and normal weight (282.6 ± 28.35), also overweight patients showed a significant increase (P<0.0001) in comparison with normal weight.

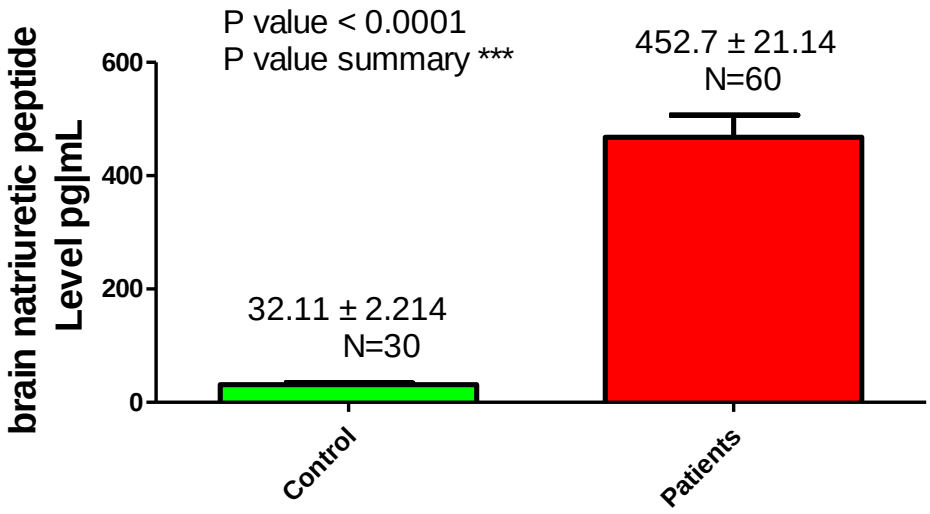

Figure 1: Brain natriuretic peptide Level in patients compared with the control group

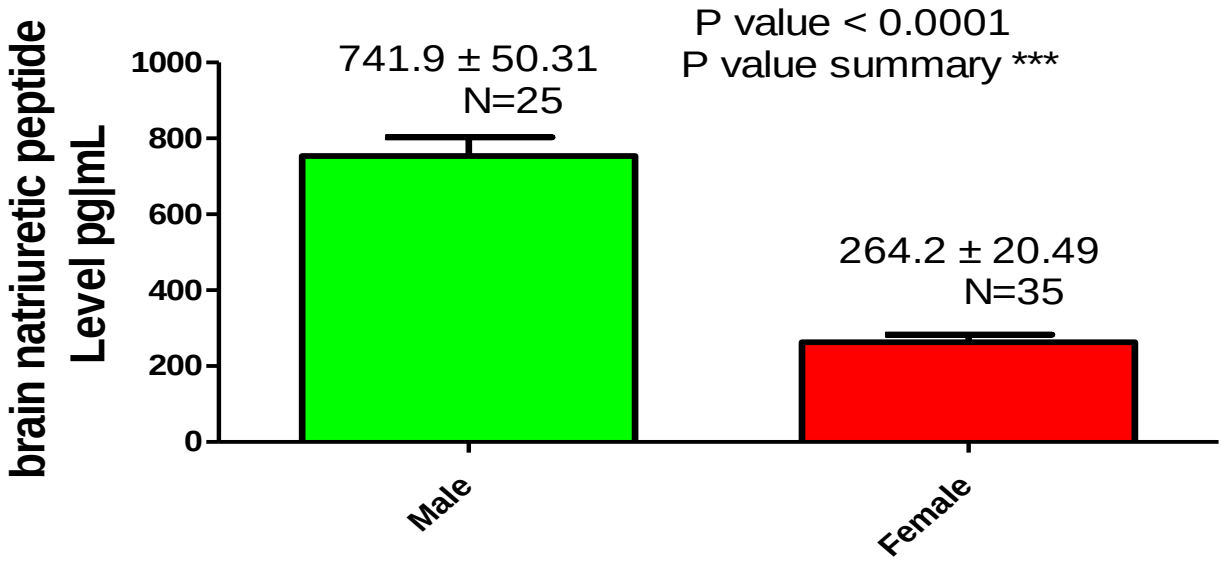

Figure 2: Brain natriuretic peptide Level in Male patients compared with Female patients

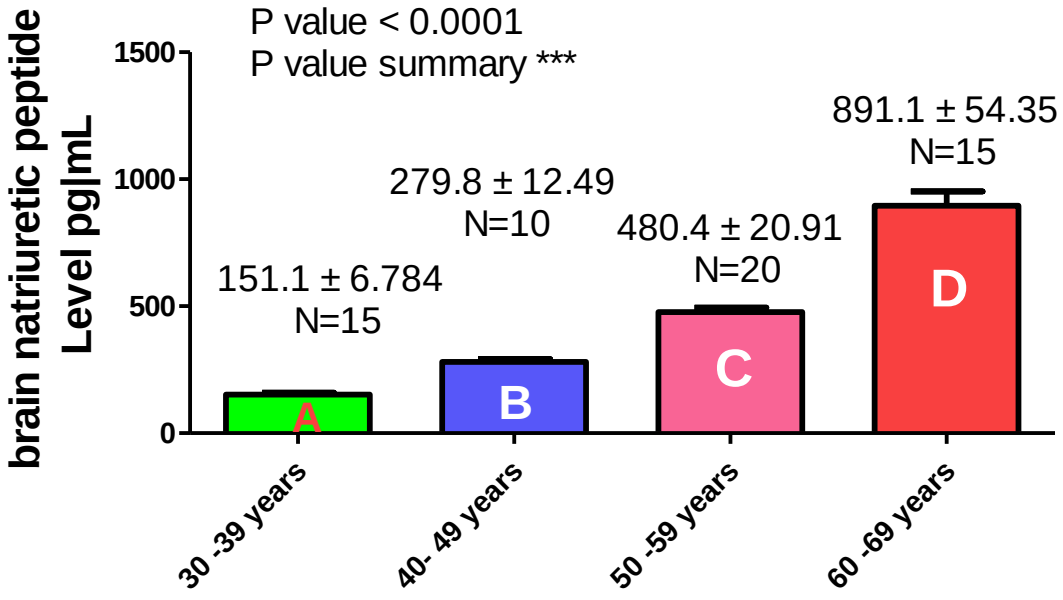

Figure 3: Brain natriuretic peptide Level in different age patients.

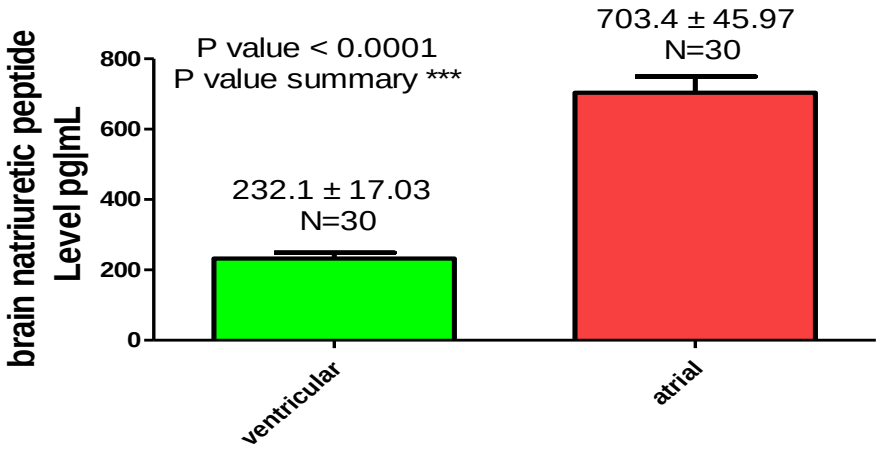

Figure 4: Brain natriuretic peptide Level in ventricular compared with atrial patients.

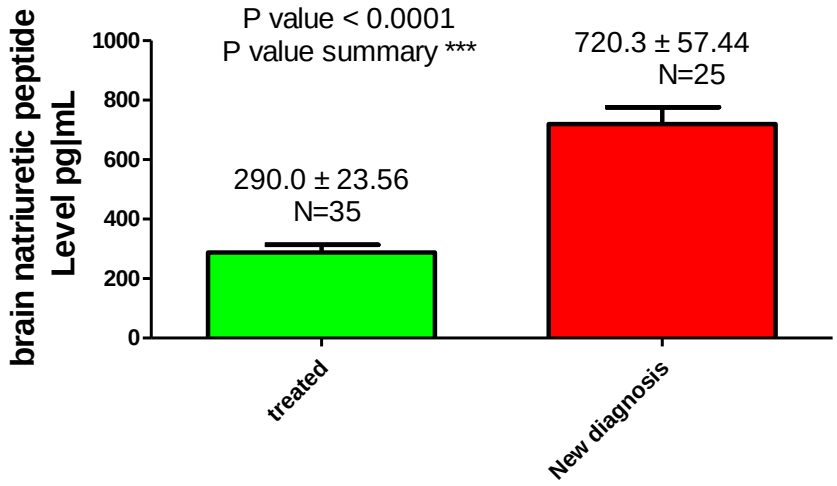

Figure 5: Brain natriuretic peptide Level in new diagnoses compared with treated patients

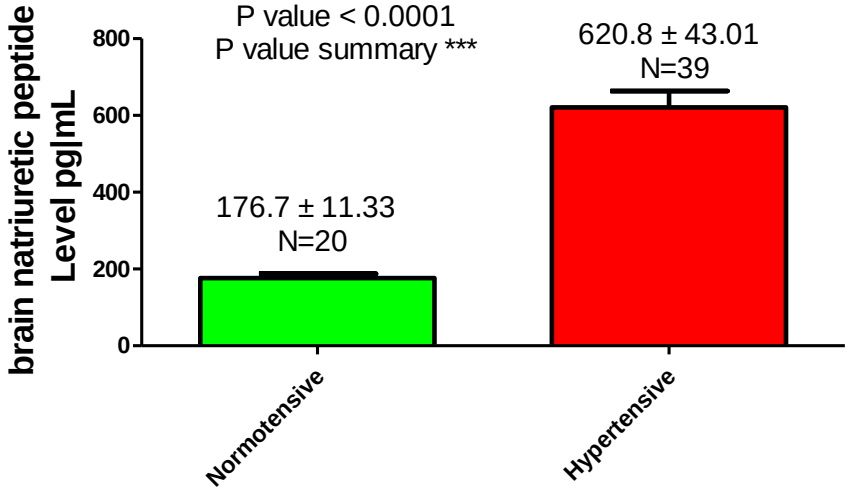

Figure 6: Brain natriuretic peptide Level in normotensive compared with hypertensive patients

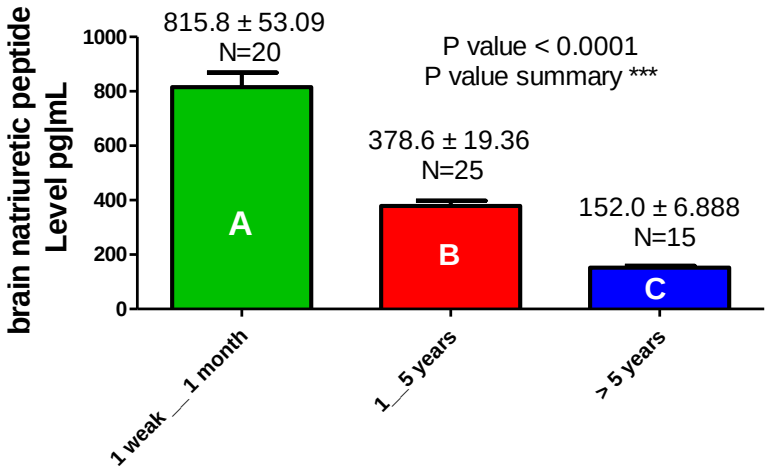

Figure 7: Brain natriuretic peptide Level according to the duration of patients

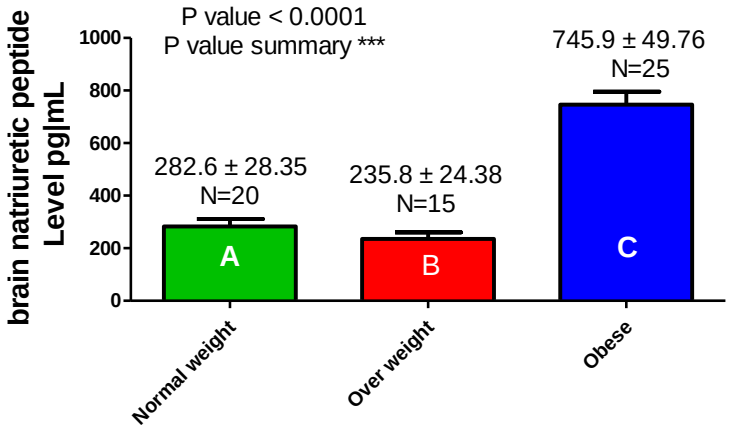

Figure 8: Brain natriuretic peptide Level according to body mass index

Discussion

Figure 1 showed a signification increase ($P < 0.05$) in patients compared with the control groups.

A recent study has explained the role of (BNP) level in atrial contraction (Atrial fibrillation) and ventricular premature contraction and showed that increased atrial fibrillation and ventricular hypertrophy are associated with high levels of BNP and considered as biomarkers for early detection of premature heart contraction, also lower (BNP) level with no atrial fibrillation (9). Another recent study has documented that BNP with a higher concentration is a prognostic marker for atrial fibrillation or a risk factor before ablation, and lower BNP was shown after ablation (10). The lower BNP level after follow-up of patients for 3 months with arrhythmia (11).

Several researchers on BNP have indicated a prognostic marker secreted by cardiomyocytes in response to wall stress associated with atrial fibrillation and tachycardia (arrhythmia), and a low level of Baseline BNP with arrhythmia recurrence (12,13). In a previous study, it was shown that atrial fibrillation was 53.3% at high rates related to a high level of BNP (14). Recent research by (15) suggested that a BNP is a neurohormone secreted

by cardiomyocytes, which is predictive of new onset atrial fibrillation in patients with nonsurgical conditions.

In a former studies has been explained that BNP is mainly synthesized by the left ventricles and enters circulation through the coronary sinus and is considered a sensitive index for reflecting ventricular load and function; therefore, any stress, tension pressure overload with changes of the electrocardiogram may be associated with high levels of BNP (16). Many mechanisms have been proven that abnormal depolarization and pathogenesis of ventricular arrhythmia and physiological changes associated with hypertension, with abnormal electrocardiograph (ECG), were correlated with high levels of BNP (17).

In a very recent studies have been suggested, a very relationship between premature atrial contraction and atrial fibrillation with high concentration of BNP with high atrial diameter (LAD), p-wave terminal force at load also, pv-interval as well as number of premature atrial contraction count especially >10 beats on twenty-four hour found atrial diameter ≥ 38.5 mm, p-wave ≥ 4.0 Mv.sec prolong P-R. (18) Several studies have suggested that high AF is associated with or predicted based on the number of BNP (19).

In a study of (20), it has been proposed that atrial fibrillation is the most prevalent of cardiac arrhythmias and premature atrial contraction that cause morbidity and mortality, and high BNP was associated with atrial stretch, enlargement, volume overload, and fibrosis of the atrium in atrial fibrillation patients.

The mechanism of supraventricular ectopy has been suggested to correlate with both high levels of NT-pro BNP or Troponin and widely increased in atrial fibrillation and supraventricular ectopic activity with existing electrical abnormality, as well as atrial dilation, which leads to atrial myopathy (21).

The previous study has proved that high BNP is associated with increased left ventricular rate and oxygen mismatch, overload in pressure and volume, blood flow changes, especially in microvascular blood flow, and as a result of these events, high production of BNP was produced (22).

In a study, of postulated the plasmatic both BNP and NT-proBNP are used to predict future atrial fibrillation. Also, the concentration of BNP decreases after restoration of sinus rhythm (23).

In recent research has been suggested that BNP has a high value for prognostic markers and risk factor for atrial fibrillation, leading to the development of cardiovascular disease and risk of mortality. In addition, atrial flutter also highly occurrence with high concentrations of BNP (24).

In a study has been explained a restoration of sinus rhythm was corrected with a decrease of both BNP and atrial fibrillation as a result of decreased inflammation, ventricular and atrial endothelial dysfunction (25).

In recent article proved an association between recurrence of atrial fibrillation and BNP because high degree of inflammation and dysfunction in sinus rhythm (SR) with high left ventricular ejection fraction (LVEF) (26).

A study dealing with the estimation of atrial natriuretic peptide (ANP) and BNP indicated that ANP was normal, but BNP was high level and explained the reason for high BNP to secrete a small amount of BNP from atria in addition to ventricles, and contraction of myocardium in atria produces a high effect on myocardium fiber leading to activated BNP in atrial fibrillation (27).

In recent report showed that atrial fibrillation, supraventricular arrhythmia, and extrasystole increase the risk of atrial fibrillation and premature atrial contraction, and these events occur in parallel with myocardial apoptosis and necrosis (28). In a study, of reported that lower baseline BNP level

catheter ablation for atrial fibrillation also associated with improvement of left a ventricular ejection fraction and normal of electrocardiogram.

In very recent research, it was found that several factors that contribute to stretching wall tension of the heart have a relationship with high BNP level, and these factors include AF-rhythm, diastolic dysfunction, and heart failure (29). In a previous study has been proven that BNP is more stable than ANP in secretion and storage, in ventricles; therefore, BNP is considered a predictive marker for premature atrial contraction and ventricles (30).

A study was suggested the role of BNP level in detection of paroxysmal atrial fibrillation and found higher level in atrial tachycardia (AT) and atrial fibrillation (AF) and used as diagnostic markers and discuss that phenomena as pathophysiological changes lead to hemodynamic load and atrial stretch also abnormal, depolarization of the heart and P-wave, may lead to AT and AF (31).

Figure 2 of the present study indicated a signification increase in male patients than females. No previous study deals with the level of BNP in males in comparison with females in premature contraction patients; therefore, many reasons for contraction in females, especially at a younger age, play a protective role against disease, and these decrease after menopause, while males have a risk factor at a younger age, represented by testosterone.

Figure 3 of the current results showed that older age, 60-69 years, significantly increases BNP than other ages. These results agree with some studies that showed a common arrhythmia and AF prevalence 5% over 65 years, and are mostly common in elderly subjects, and BNP level positively correlates with age (32). The present data in Figure 4 showed a signification increase in atrial premature in comparison with ventricles. No previous research deals with a comparison between atria and ventricles. The explanation may be discussing atrial fibrillation. Flutter is most common due to atrial stretch, depolarization, and P-wave disturbances, accompanied by a higher level of BNP than ventricles.

Figure 5 and Figure 6 revealed a signification increase in BNP level in new diagnoses of patients than treated and duration of disease 1 week to 1 month than others. Several recent studies have proved that BNP with high level of BNP with new diagnosed patients and considered a predictive biomarker for both atrial and ventricular premature contraction, and this peptide new onset atrial fibrillation, ventricular arrhythmia (33,34). Some studies have suggested that a high level of BNP in atrial fibrillation patients before surgery or any treatment, such as an antiarrhythmic drug, was successful in reducing BNP (35,36).

The current results in Figure 7 showed a higher BNP in hypertensive patients than in normotensive in premature heart contraction. Recent studies agree with the present results and suggest that BNP level modification and association with high concentration with aggressive blood pressure in atrial fibrillation, atrial fibrosis, LVEF, and systolic blood pressure than others (37).

Figure 8 in the current results showed that the BNP level is higher in obese individuals than in overweight and normal individuals. Very little data correlates body mass index with atrial and ventricular premature contraction, except the study of (38) that associates both gender, age, and body mass index with high BNP level. Obesity may be considered a risk factor that may cause high blood pressure, abnormal heart rhythm, stretching of the atrial wall, supraventricular ejection fraction, and increased depolarization of the sinus node with disturbances in ECG reading by P-wave.

Conclusion

1-The current results concluded that the severity of disease is associated with males more than females in biomarker levels.

2-The patients that new diagnosed with a duration of disease (1 weak-1 month) were highly affected by biomarker levels.

3-Older ages are also high blood pressure, with high body mass index considered as a risk factor for premature heart contraction due to high levels of biomarkers.

Conflict of interest: NIL

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