RESEARCH ARTICLE

A Comparative Study Regarding BNP Levels in Heart Failure with Preserved Ejection Fraction in Patients in Normal Sinus Rhythm Versus Those with Atrial Fibrillation

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Received: 16th Nov, 2024; Revised: 20th Nov, 2024; Accepted: 25th Nov, 2024; Available Online: 25th Dec, 2024

ABSTRACT

Background: Due to overlap in symptoms and risk factors, it may be difficult to diagnose Heart Failure with Preserved Ejection Fraction (HFpEF) in the presence of atrial fibrillation (AF). Additionally, both AF and HF affect the concentrations of biomarkers, including circulating natriuretic peptides. The aim of this work was to compare BNP levels in HFpEF patients presented with HFpEF in AF versus those in normal sinus rhythm (SR) and to propose a cut-off level of BNP for diagnosis of HFpEF in patients in SR and in AF.

Methods: This cross-sectional observational control study was conducted included 120 patients. Patients were allocated into four equal groups Group A: HFpEF patients in normal SR. Group B: HFpEF patients with AF. Group C: A control group without HFpEF and in SR. Group D: control group without HFpEF and in AF.

Results: Circulating BNP levels are significantly higher among AF group of patients who were diagnosed with HFpEF. This may impact the previously proposed cutoff value for HFpEF diagnosis in this specific group of patients. Using the Roc curve analysis for BNP to propose a cutoff value for diagnosis of HFpEF in AF cases. The best cutoff point to discriminate HFpEF cases in AF was BNP> 459 pg/ml with a sensitivity and specificity of 76.67% and 83.33% respectively and area under curve of 0.813. While a cut off value of 89 pg/ ml can be used as a cut off level for HFpEF diagnosis in SR. Higher LV filling pressures and more symptoms were detected in HFpEF patients with AF. Also a positive correlation was detected between BNP levels and non-invasively estimated filling pressures in the form, of "LAVI, TR velocity and LA volume index with an r value of 0.8, 0.84 and 0.83 respectively and p value <0.001.

Conclusions: Circulating BNP levels are significantly higher among AF group of patients who were diagnosed with HFpEF. BNP at a cutoff value for diagnosis of HFpEF showed that the area under the curve was 0.813 and the best cutoff point to discriminate HFpEF cases in AF was BNP> 459 pg/ml with a sensitivity of 76.67% and a specificity of 83.33 PPV of 82.1, NPV of 78.1 and P-value <0.001 and a cutoff level of 89 pg/ ml for HFpEF diagnosis in SR.

Keywords: Heart failure, Preserved ejection fraction, HFpEF, BNP, Atrial Fibrillation.

How to cite this article: Nurses' Attitudes towards Medication Error Reporting and Maintaining Pharmaceutical Quality Assurance: A Systematic Review. International Journal of Pharmaceutical Quality Assurance. 2024;15(4):2225-31. doi: 10.25258/ijpqa.15.4.16

Source of support: Nil.

Conflict of interest: None

INTRODUCTION

Compared to heart failure (HF) with reduced ejection fraction, HF with preserved ejection fraction is a more heterogeneous syndrome, having very common comorbid conditions and a greater incidence in the elderly, obese, and female populations. Since symptoms and risk factors frequently overlap, diagnosing HFpEF in the presence of AF may be a challenge. Further complicating the diagnosis of HFpEF is the reason that biomarkers levels, including circulating natriuretic peptides, are affected by both HF and AF. Because of this, different cut-offs for those natriuretic peptides are employed in the majority of current HF studies for individuals with SR and those in AF. But the precise cut-offs utilized are still arbitrarily and widely debated. [1, 2]. A very high level of epidemiological and clinical convergence is seen in HFpEF and AF. Whichever condition manifests first, both are present or will soon be present in the same individuals. Ventricular and atrial myopathy seems to be the common underlying conditions that causes both AF and HFpEF. [3]. Patients with HFpEF are susceptible to AF, with an incidence of 20% to 65% due to the left atrial (LA) remodeling brought on by the elevated left ventricle (LV) stiffness. [1, 4]. AF may have a major negative impact on the already fragile hemodynamic condition seen in patients with HFpEF due to LV diastolic dysfunction, resulting in a lack of atrial contraction, inadequate filling of the ventricles, and a decrease in cardiac output. In fact, it has been proposed that having AF and HFpEF together has a poorer prognosis than either illness by itself. [5, 6]. Due to its tight relationship with both HFpEF and criteria for diagnosis utilized to identify HFpEF, AF is a significant confounder of the HFpEF diagnosis. The following criteria are met for the diagnosis of HFpEF: 1- typical HF signs and symptoms, 2- preserved left ventricular (LV) EF, and 3- indications of LV diastolic dysfunction (such as LA enlargement). To confirm the diagnosis, circulating natriuretic peptides like N-terminal pro-B-type natriuretic peptide (NT-proBNP) may be employed. However, AF

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itself causes exercise intolerance, enlargement of LA, and elevated NT-proBNP, regardless of whether there is no overt HF [7] [8].

AF is linked to serious symptoms and higher levels of certain biomarkers and a more deleterious outcomes than SR in HFpEF [9], also with a higher level of natriuretic peptides and even more symptoms regardless of HF status. Hence, our study was conducted to propose a diagnostic cut-off value of BNP in HFpEF with AF and correlate our findings to patients' functional classification, non-invasively estimated filling pressures which in turn may aid us for an earlier and more proper diagnosis, a better prognostication and management and another perspective to revisit the rhythm concept vs, rate-control approaches for instances of HFpEF with AF.

The purpose of this study was to contrast BNP levels in HFpEF individuals with AF versus those in normal SR and a cut-off level of BNP for diagnosis of HFpEF in patients in SR and in AF.

Table 1: Relation between the studied groups, demographic data, NYHA functional class and the risk factors

		HFpEF patients in Sinus rhythm(A)	**HFpEF patients in AF(B)**	**Control group in sinus rhythm(C)**	**Control group in AF(D)**	**P value**			
		Demographic data							
Age		58.43±10.76	53.6±9.79	55.5±9.62	53.5±9.74	0.193			
Sex	**Male**	19 (63.33%)	18 (60%)	20 (66.67%)	15 (50%)	0.584			
	Female	11 (36.67%)	12 (40%)	10 (33.33%)	15 (50%)				
BMI		28.3±6.18	31.66±5.7	28.39±6.31	30.11±6.39	0.114			
NYHA	**I**	8 (26.7%)	5 (16.7%)	30 (100.0%)	16 (53.3%)	<0.001			
	II	8 (26.7%)	6 (20.0%)	0 (0.0%)	14 (46.7%)				
	III	8 (26.7%)	13 (43.3%)	0 (0.0%)	0 (0.0%)				
	IV	6 (20.0%)	6 (20.0%)	0 (0.0%)	0 (0.0%)				
						A Vs B	**A Vs C**	**B Vs D**	**C Vs D**
						0.042	<0.001	<0.001	<0.001
The risk factors									
HTN		20 (66.67%)	19 (63.33%)	11 (36.67%)	18 (60.0%)	0.079			
DM		7 (23.33%)	7 (23.33%)	4 (13.33%)	12 (40.0%)	0.118			

*One Way ANOVA test of significance (f). *Chi-Square test of significance (X^2). * Each subscript letter denotes a subset of Group categories whose column proportions do not differ significantly from each other at the .05 level. * The control AF group was obtained from patients presenting to the electrophysiology clinic with symptoms attributed to AF.

Table 2: Relation between the studied groups, laboratory work up and BNP:

	HFpEF patients in Sinus rhythm(A)	**HFpEF patients in AF(B)**	**Control group in sinus rhythm(C)**	**Control group n AF(D)**	**Test of significance**		
	Median (IQR)	**Median (IQR)**	**Median (IQR)**	**Median (IQR)**	**p-Value**		
HbA1c	5.67±1.22	5.79±1.13	5.58±0.90	6.09±1.40	0.360		
LDL	147.23±31.60	144.90±32.72	142.70±35.91	153.47±36.72	0.649		
CrCL	63.7±15.22	58.5±12.43	67.6±14.31	66.37±13.35	0.060		
BNP	396 (321 - 449)	581.5 (468 - 702)	42 (29 - 63)	117 (92 - 134)	<0.001**(K1)**		
	A Vs B	**A Vs C**	**B Vs D**	**C Vs D**	**A Vs B**	**A Vs C**	**B Vs D**
	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

*****One Way ANOVA test of significance (f), *Post-hoc Bonferroni test was significant between, **(A1)** AF without heart failure group Vs. (Control, Sinus rhythm and AFIB, **(A2)** Control group Vs. (AF without heart failure, Sinus rhythm and AFIB groups).

Patients and Methods:

On 120 patients, this cross sectional observational control research was conducted in Beni-suef University hospital and Aswan Heart Centre in the period between (March 2021 to March 2022).

In accordance with the Helsinki Declaration, this research was carried out on July 6, 2021, with the ethics committee of Beni-Suef University Hospital's consent. All patients

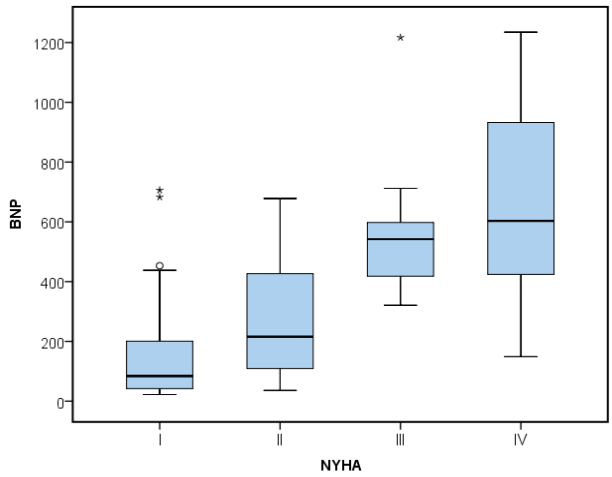


Figure 1: Correlation between BNP and NYHA

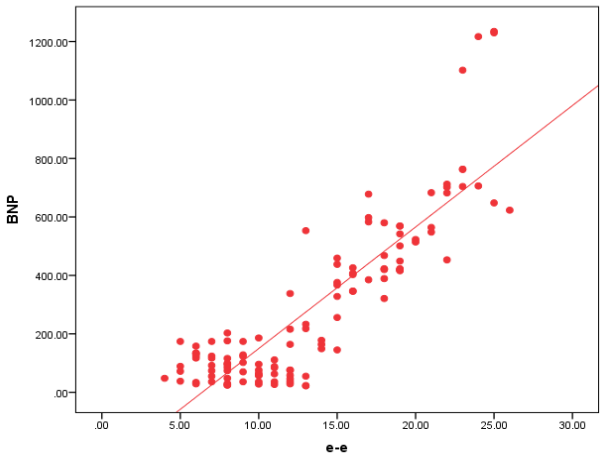
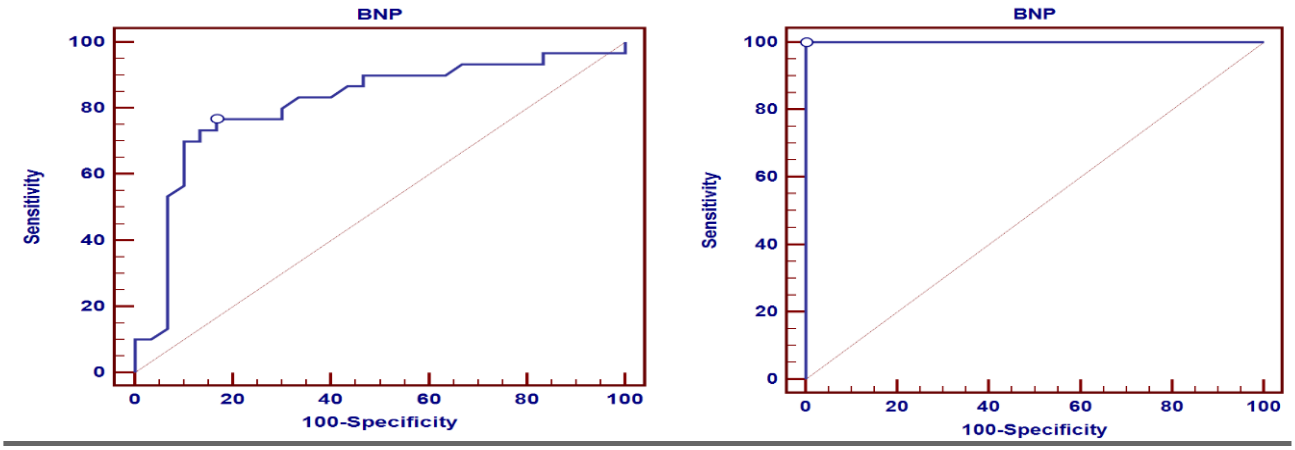


Figure 2: Correlation between BNP and average E/e` values



(A) **(B)**

Figure 3: ROC curve for BNP cut off level in (A) AF-HFPEF (B) in SR-HFpEF

provided written permission after being fully informed.

The study's enrolled participants were split into 4 groups, each with thirty participants.

Group (A): HFpEF individuals in normal SR. Group (B): HFpEF patients with AF. Group (C): A control group without HFpEF and in SR. Group (D): A control group without HFpEF and in AF.

Inclusion criteria: For group (A & B): patients should met the clinically defined criteria of HFpEF according to ESC 2021 task force definition: The presence of HF symptoms and signs according to criteria of Framingham: “two majors or one major + 2 minors for HF diagnosis”. Major criteria include (cardiomegaly, acute pulmonary edema, hepato-jugular reflex, orthopnea, distension of neck vein, rales, loss of weight more tha 4.5 kg in response to therapy, and third heart sound gallop). Minor criteria include: "Pleural Effusion, Ankle edema, Dyspnea on exercise, Nocturnal cough, Hepatomegaly, and Tachycardia higher than 120 BPM. LVEF greater than 50%. B-type natriuretic peptide: BNP > 35 pg/ml) levels are higher. According to the HFA-PEFF scoring system, there is empirical proof for cardiac anatomical and/or functional deficiencies that are in line with the existence of LV diastolic dysfunction/ elevated LV filling pressures, such as LA volume index, LV mass index, E/e' and tricuspid regurgitation velocity.

For the control groups: age > 18 years, ejection fraction > 55% and no objective evidence of HF “either functional, morphological or biochemical HFA-PEFF score < 3”.

Exclusion criteria were other causes of severe aortic regurgitation, aortic stenosis, mitral regurgitation, mitral stenosis, acute coronary syndrome when admitted, congenital heart diseases and hemodynamically unstable patients.

All patients had thorough taking of history, comprehensive clinical examinations, and laboratory tests (CBC, kidney function tests (serum urea and creatinine), creatinine clearance based upon Cockcroft-Gault equation, HBA1C, lipid profile and BNP level), ECG and transthoracic echocardiography.

BNP level collected from venous blood samples were gathered and placed in tubes that contained EDTA and BNP levels were assessed utilizing an electrochemiluminescence immunoassay on an Elecsys 2010 system.

12 leads resting ECG utilizing a 3-channel direct-write recorder with a paper velocity of 25 mm/s and

standardization set to 1 mm/mv to differentiate patients into those with SR and AF. Cardinal ECG features of SR: Regular QRS complexes with p wave preceding each QRS complexes. AF's cardinal ECG characteristics: Total RR interval irregularity, a lack of P-waves, and baseline fibrillation waves that are either fine or coarse. According to the ESC AF guidelines published on 2020, ECGs with a standard 12-lead configuration or single-lead ECG tracings longer than 30 seconds must be used to diagnose clinical AF.

Table 3: Relation between the studied groups and left ventricular filling pressures estimated by echocardiography

	HFpEF patients in Sinus rhythm(A)	**HFpEF patients in AF(B)**	**Control group in sinus rhythm(C)**	**Control group in AF(D)**	**One way ANOVA**
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	p-Value
EF	62.1 ± 6.26	59.57 ± 6.39	60.63 ± 6.71	63.5 ± 4.42	0.067
e prime	5.5 ± 1.53	5.3 ± 1.49	13.03 ± 1.69	13.07 ± 1.34	<0.001**(A1)**
Average E/e`	16.63 ± 3.06	19.9 ± 3.57	9.63 ± 2.53	7.7 ± 1.73	<0.001**(A2)**
TR velocity	3.29 ± 0.6	3.49 ± 0.58	0.49 ± 0.84	1.43 ± 1.18	<0.001**(A3)**
Left atrial volume index	33.03 ± 7.07	46.4 ± 7.72	16.93 ± 3.05	31.67 ± 7.18	<0.001**(A4)**
LV mass index	90.87 ± 22.87	105.8 ± 20.31	70.87 ± 7.21	75.2 ± 12.32	<0.001**(A5)**
Post Hoc analysis					
	A Vs B	**A Vs C**	**B Vs D**	**C Vs D**	
E prime	0.610	<0.001	<0.001	0.932	
Average E/e`	<0.001	<0.001	<0.001	0.009	
TR velocity	0.112	0.001	<0.001	0.240	
Left atrial volume index	<0.001	<0.001	<0.001	<0.001	
LV mass index	0.003	<0.001	<0.001	0.334	

*****One Way ANOVA test of significance (f), *Post-hoc Bonferroni test was significant between, **(A1)** (Control and AF without heart failure groups) Vs. (Sinus rhythm and AFIB groups), **(A2)** Between all groups, **(A3)** Control group Vs. (Sinus rhythm and AFIB groups). And AF without heart failure VS. AFIB group, **(A4)** Between all groups except (Sinus rhythm Vs. AFIB groups), **(A5)** Between all groups except (AF without heart failure VS. Control group).

Table 4: Correlation between the HFA-PEFF scoring system of both HfpEF groups, NYHA functional class and the BNP levels:

		HFA-PEFF score	
		Group A	**Group B**
NYHA	I	4	5
	II	5	6
	III	6	6
	IV	6	6
	P-value	0.001	0.009
BNP	**r**	0.297	**0.613****
	P value	0.110	**<0.001**
P-value > 0.05: Non-significant; P-value < 0.05: Significant; P-value < 0.01: Highly significant ≠: Kruskal-Wallis test and Spearman correlation coefficient			

Transthoracic echocardiography including:
Parasternal long axis view "Mmode" (End systolic dimension, end diastolic dimension, thickness of posterior and septal wall and Indexing LV mass to surface area of body by "Ranges & Partition equation. "0.8 (1.04 ([LVIDd + PWTd + IVSTD]3 − [LVIDd]3)) + 0.6 g LVIDd"
The LV's apical 2, 3 and 4 chamber views were recorded (ejection fraction was determined utilizing the biplane Simpson's technique, and LAV was assigned an index to the surface area of the body, pulsed wave Doppler of the mitral valve: from the apical four chamber view and from the early E and late A "in case of SR cases" peak diastolic velocities were measured, E' lateral and septal mitral leaflets velocity were measured using tissue Doppler, E/e' ratio was determined by dividing E by average e' septal and lateral velocity and TR peak velocity).

Sample Size Calculation:

G*Power 3.1.9.2 (Universität Kiel, Germany) was used to calculate the sample size.

According to a previous study (Ref), the mean ± SD of adiponectin (the primary outcome) was 6.33±1.05 μg/mL before intervention and 6.94±1.20 μg/mL after intervention. The sample size was based on the following considerations: 0.5 effect size, 95% confidence limit, 99% power of the

Table 5: Multiple linear regression analysis for prediction of BNP

Independent variables	Coefficient	Std. Error	t	P value
Constant	**-401.118**			
EE	**19.615**	**3.802**	**5.159**	**<0.001***
TR velocity	**-1.949**	**4.572**	**-0.426**	**0.671**
LAVI	**9.644**	**1.526**	**6.319**	**<0.001***
LV mass	**1.544**	**0.925**	**1.670**	**0.098**

*: Significant as P value ≤0.05.

study, groups ratio 1:1. Therefore, we recruited 30 patients in each group.

Statistical analysis

(IBM, Chicago, IL, USA)'s SPSS v27 was used for the statistical analysis. Histograms and the Shapiro-Wilks test were used to assess the data distribution normality. The mean and standard deviation (SD) of quantitative parametric variables were reported, and an ANOVA (F) test with a post hoc test (Tukey) was used to analyse them. In order to compare each group, quantitative non-parametric data were provided as median and interquartile range (IQR) and were then analysed using the Kruskal-Wallis test and Mann Whitney-test. The Chi-square test was used to analyse qualitative data, which were reported as frequency and percentage (%). A two-tailed P value of < 0.05 was regarded as statistically significant.

RESULTS

Demographic information, NYHA, and risk variables correlated among the groups under study. Sex, age, BMI, diabetes mellitus (DM), and hypertension did not significantly vary across the groups under study (p>0.05), but there were high substantial differences among the HFpEF and control groups, that difference was proved in case of SR and AF separately. Also, HFpEF patients in AF were more symptomatic than the SR group of patients. (**Table 1**)

No substantial variation existed between the investigated categories considering creatinine clearance HbA1c, LDL, but there was increased substantial variation among the studied groups regarding BNP (p<0.001). Among patients with HFpEF, BNP levels were shown to be increased in those with AF than those in SR "mean values were 581.5 pg/ml and 396 pg/ml respectively". Moreover, between control groups BNP values were higher among control AF group with a mean of 117 pg/ml compared to the control SR group. **(Table 2)**

No substantial variation existed among the studied group as regards ejection fraction, however there were high substantial variation among the studied groups regarding e`, average E/e` (p<0.001). Also, there were high significant differences between the studied groups regarding TR velocity value, LAVI and LV mass (p<0.001). These parameters were found to be higher among AF group of HFpEF patients. **(Table 3)**

Positive relationships exist between HFA-PEFF score and NYHA functional class among both groups of HFpEF patients "p value <0.001." There is a statistically substantial relationship between BNP levels and HFpEF patients among the AF group. However, this relationship is non-significant among the SR group of patients. **(**Error! Reference source not found.**)**

The relationship between BNP values and NYHA functional classification of HF. There is a highly significant correlation between BNP and class of NYHA. **(Figure 1)**

The higher the NYHA class of the patients, the higher the BNP levels that were detected.

There is a good positive relationship between BNP and E/e`. **Figure 2**

EE and LAVI were independent significant predictors for BNP (P value<0.001) while TR velocity and LV mass weren't. BNP can be estimated by the following equation: "BNP = -401.1 + (19.6 x EE) + (-1.9 x TR velocity) + (9.6 x LAVI) + (1.5 x LV mass)". Table 5

To establish a cut-off value of BNP for the diagnosis of HFpEF in cases of AF, receiver operating characteristic (ROC) analysis was carried out, by comparison of circulating BNP levels in both groups of HFpEF "SR and AF groups" A cutoff value of 459 pg/mL was proposed for diagnosis of HFpEF cases in AF. The sensitivity, specificity, PPV and NPV was 76.67%, 83.33%, 82.1% and 78% respectively (p< 0.001). **(**Error! Reference source not found.**A)**

To establish a BNP cut-off value for HFpEF diagnosis in SR cases, ROC analysis was used, by comparison of circulating BNP levels in both groups of SR "HFpEF and control groups" A cutoff value of 89 pg/mL was proposed for diagnosis of HFpEF cases in AF. The sensitivity, specificity of 100% (p< 0.001). **(**Error! Reference source not found.**B)**

DISCUSSION

The major findings of this study demonstrated that across individuals diagnosed with HFpEF, BNP levels were shown to be increased in individuals with AF than those in SR with significant increase in Circulating BNP levels among AF control patients than SR control group. moreover, Higher LV filling pressures were associated with HFpEF patients in AF. Also, a strong positive relationship was existed between BNP and LV filling pressures estimated non-invasively via echocardiography. It was determined that 89 pg/ml was the cut-off value for diagnosing HFpEF in SR and 459 pg/ml was recommended as the cut-off value for diagnosing HFpEF in AF cases with a sensitivity of 76% and a specificity of 83%.

The study by Zakeri et al., [10] that concluded that two thirds of patients experience AF at some point in their history., reported that BNP levels were higher in AF groups

either prior or concurrent AF as contrasted with the SR group and no statistically substantial variation was existed among HFpEF patients AF, concurrent AF, and SR as regard NYHA class (NYHA III-IV 22% & 23% & 16% respectively. P value 0.56.

Furthermore, our findings were in line with Takase et al., [11] who identified Serum creatinine, eGFR and BNP but not LDL, HDL, and Fasting plasma glucose to be a risk factors for AF in Univariate Analysis, while in Multivariate Analysis only BNP was considered as a significant risk factor for AF.

Kristensen et al., [12] examined the correlation between NT-pro BNP and results in Individuals with HFpEF with or without AF based on an evaluation of individuals enrolled in the I– Preserve or TOPCAT trials finding that levels were substantially increased in AF cases "Median 288 pg/ml contrasted to 1286 pg/ml.

In concordance with our results, Santema and his colleagues [13] reported that about 55% of the risk indicators were greater in SR than in HFpEF, and the biomarkers profile was substantially more dispersed and 39% were higher in AF and the risk factor that differed the most between AF and SR was NT-proBNP. Higher NT-ProBNP were shown among AF group of patients "802 pg/ml compared to 2395 pg/ml".

Moreover, results from the NEAT-HFpEF trial by Patel et al., [14] showed that following adjusting for covariates, the NT-proBNP levels in the AF cohort were found to be considerably higher at baseline; however, following isosorbide mononitrate, the levels were found to be significantly lower exclusively in the AF subgroups. Also, the indexed LA volume was significantly higher in HFpEF AF cases in comparison to HFpEF SR (46.4 versus 33.03). In addition, LAVI in AF control group was larger than the control SR group. Similar results were found regarding LV mass index (105 compared to 90) indicating high incidence of LV remodeling in these cases.

The HFA-PEFF scoring system for diagnosing of HFpEF recommended a combination of echocardiography measurements whose diagnostic cut-points may change depending on AF.[15]. These parameters include echocardiographic tissue Doppler e′ velocities, E/e′ ratio, velocity of tricuspid regurgitation, LV global longitudinal strain, index of LA volume, index of LV mass, relative wall thickness [16].

These findings were also supported by the study designed by Lam et al., [17] showed that the SR group exhibited lower e′ velocities and shorter deceleration periods compared to the AF group, which had greater E waves. Therefore, there was equality between the groups in the E/e′ ratio. (57.8 ±17.0 ml/m2 vs. 42.5±15.1 ml/m2; p=0.001) LAVI was higher in AF than SR. Intriguingly, in the AF group, function of right ventricular systole (tricuspid annular plane systolic excursion [TAPSE]) was even more diminished. Moreover, Higher NT- pro-BNP was associated with AF even after adjusting all other covariates.

Similar findings were found in a post-hoc analysis performed on the Relax trial designed by Margaret et al., stating that AF in HFpEF was associated with similar E/e' but with higher pulmonary artery systolic pressures, shorter time of deceleration, larger left atria. levels of N terminal pro-BNP were substantially increased among the AF group of patients. They also found that these specific group of patients used more diuretics denoting more symptoms [18].

Furthermore, the study by Harada et al., [19] reported that the level of BNP was a strong correlation with E/e'. In contrast to those with HFrEF who had similar elevated E/e' or LV end-diastolic pressures, the hearts of the HFpEF patients showed smaller LV cavity sizes, relatively thicker walls, and higher prevalences of LV concentric remodelling/ hypertrophy (87% vs. 49%, P<0.001) and much lower prevalences of eccentric hypertrophy (9% vs. 46%, P<0.001).

In accordance with our findings, Knudsen et al. [20] found that a BNP cut-off value of 100 pg/ml showed a specificity of only 40% while the sensitivity was 95% for those with permanent/paroxysmal AF. Unsurprisingly, when BNP cutoff levels rose in both patient categories, specificity rose and sensitivity fell. At a BNP cut-off value of 200 pg/ml for those with permanent/paroxysmal AF and 84.5 for individuals without AF, the maximum accuracy in both patient groups were obtained.

According to the HFA-PEF diagnostic algorithm proposed by the HFA of the ESC integrating initial clinical and creating a diagnostic score from complimentary diagnostic domains for diagnosis of HFpEF stated that average NPs have been reported to be 3-3.5-fold higher in patients of AF than patients in SR, but definitive cut-off levels haven't yet been established [15, 16].

Limitations: In our definition of AF, we didn't differentiate between different disease patterns, persistent, permanent, paroxysmal AF, leaving unresolved whether our findings would vary by specific AF pattern. Based on prior medical data or patient information, persistent or paroxysmal AF is interpreted. This might lead to an underestimation of the presence of AF. Small sample size, larger samples are needed to confirm the diagnosis.

CONCLUSION

Circulating BNP levels are significantly higher among AF group of patients who were diagnosed with HFpEF. This may impact the previously proposed cutoff value for HFpEF diagnosis in this specific group of patients. Using the Roc curve analysis for BNP to propose a cutoff value for diagnosis of HFpEF in AF cases by comparing BNP values among both HFpEF groups "SR and AF", It showed that the area under the curve was 0.813 and the best cutoff point to discriminate HFpEF cases in AF was BNP> 459 pg/ml with a sensitivity of 76.67% and a specificity of 83.33 PPV of 82.1, NPV of 78.1, CI 0 .695 – 0.930 and P-value <0.001 and a cutoff level of 89 pg/ ml for HFpEF diagnosis in SR.

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