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Diagnostic Utility of NT-Pro BNP in Elderly Patients Presenting With Acute Dyspnea in Emergency Department of Tertiary Level Teaching Hospital

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ABSTRACT

Background: Acute dyspnea may be related to lungs pathology or cardiac pathology or due to involvement of both. Rapid diagnosis of the cause of dyspnea in emergency can help in early start of treatment preventing further progress of the symptoms, prolong hospital stay, need of more invasive medical procedures like intubation and ventilation thereby decrease the morbidity and mortality of the patients.

Methods: The study was conducted for three months i.e, from 16th May 2023 till 17th August 2023. Among 150 patients fulfilling inclusion criteria were taken. Clinical diagnosis in these patients was established based on medical history as well as echo and chest X-ray. Based on their clinical diagnosis, the patients were divided into three groups: group A diagnosed with pulmonary dyspnea (PD), group B diagnosed with congestive heart failure (CHF), and group C diagnosed with combined dyspnea (CHF+PD). NT-proBNP level in these patients was measured and compared.

Results: The study population constituted 60% males and 40% female with mean age of 68.9±10.99. Out of 150 patients presenting with acute dyspnea in emergency department, 65 patients were diagnosed with congestive heart failure, 55 patients were diagnosed with pulmonary dyspnea and 30 patients diagnosed with combined dyspnea. Average NT-proBNP among group A patients was (1300±175) ng/l, among group B patients was (275±70) ng/l and among group C patients was (1276±165) ng/l.

Conclusion: NT-proBNP is the reliable marker to differentiate the cardiac and pulmonary causes of acute dyspnea among elderly patients presenting to emergency.

Keywords: n-terminal pro-B-type natriuretic peptide (NT-proBNP); emergency; elderly patients; dyspnea; biomarker.

INTRODUCTION

Elderly patients presenting with acute dyspnea is the common medical scenario for emergency department (ED) and is mostly related to lungs pathology, cardiac pathology or both.[1, 2] Bed-side 2-D echocardiography, a reliable test to rule out the cardiac cause of acute dyspnea is limited by its availability and lack of skilled operator.[3] In such context, NT-pro BNP can help the emergency physician to rapidly differentiate the cause of acute dyspnea that has close association with heart failure severity.[4] Also recommended by ACC/AHA, it has longer half-life and its more consistent blood levels is regarded as better marker of early heart failure for initiation of early treatment and its prognosis.[5-9] However, influenced by conditions like Chronic Obstructive Pulmonary Disease(COPD), Pulmonary Embolism, Renal Dysfunction, arrythmias, age, sex and weight, it is useful for being inversely proportional with cardiac ejection-fraction according to severity and also predicts mortality in dyspnic patient.[5, 10, 11] Thus, here we attempt to determine the significance of NT-proBNP estimation in patients with acute dyspnea presenting in emergency settings.

METHOD

This cross sectional study was conducted for three

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months i.e. from 16th May 2023 till 17th August 2023. Non-probability purposive sampling technique used to select total 150 Elderly patients above 60 years presenting with dyspnea in emergency of COMS Hospital. Dyspnea caused by trauma, pericardial tamponade, or acute coronary artery syndrome was excluded from the study, as well as those with renal failure, ascites caused by cirrhosis, or thyroid diseases. Ethical approval was taken from Institutional review committee of Collegeg of Medical Sciences (COMSTH-IRC/2023-14). Demographic and clinical details of the patients were taken. The routine blood testing, blood biochemistry, blood gas analysis, and electrocardiography, measurement of blood NT-proBNP levels, doppler echocardiography, left ventricular ejection fraction (LVEF) measurement, and X-ray radiography was performed within an hour after patient admission. Based on their clinical diagnosis, the patients were divided into three groups: group A diagnosed with congestive heart failure (CHF), group B diagnosed with pulmonary dyspnea (PD), and group C diagnosed with combined dyspnea (CHF+PD). NT-proBNP levels among the three groups was compared. CHF was diagnosed based on clinical history, Doppler echocardiogram and chest x-ray. These patients constituted those with coronary artery disease, hypertensive heart disease, dilated cardiomyopathy, valvular heart disease and hypertrophic cardiomyopathy. Pulmonary dyspnea included patients with chronic obstructive pulmonary disease (COPD), bronchial asthma, interstitial lungs disease, pneumonia, pleural effusion and pneumothorax. Combined dyspnea included patients with both cardiac and pulmonary conditions. Data were statistically analyzed using SPSS 17 software. Means and standard deviation (SD) were determined.

RESULTS

The study population constituted 60% males and 40% female, with mean age of 68.9±10.99 (Figure 1).

Group A included 65 cases of acute dyspnea as the result of congestive cardiac failure (CCF). It constituted 20 cases of ischemic heart diseases, 15 cases of hypertensive cardiac disease, 13 cases of dilated cardiomyopathy, 12 cases of rheumatic heart disease and 5 cases of hypertrophic cardiomyopathy (Figure 2).

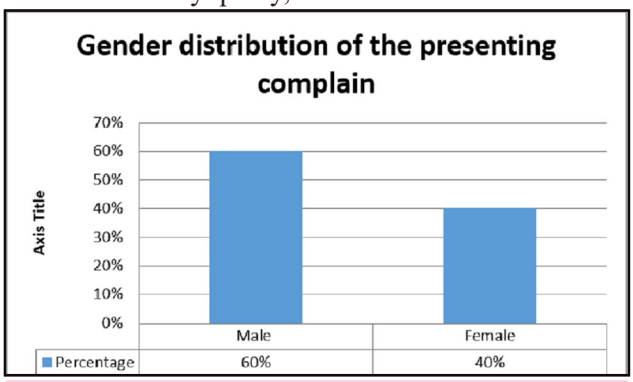

Figure1. Percentage of adult Male and Female presenting with the acute dyspnea. (n=150)

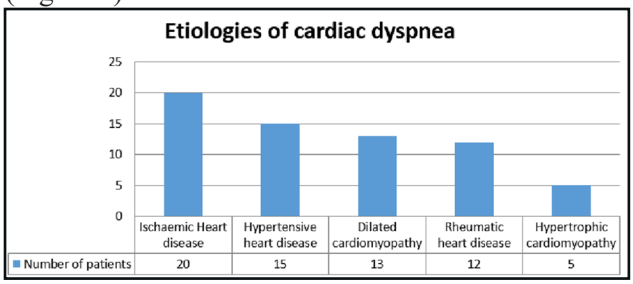

Figure 2. Etiologies of cardiac dyspnea. (n=65)

Group B consisted of 55 cases of dyspnea related to pulmonary diseases (PD). It comprised of 27 patients of acute exacerbation of chronic obstructive pulmonary disease (COPD), 7 patients with acute severe bronchial asthma, 5 patients with bronchiectasis exacerbation with infection, 5 patients with pneumonia, 5 patients with interstitial lung disease, 4 patients with massive pleural effusion, and 2 patients with pneumothorax (Figure 3).

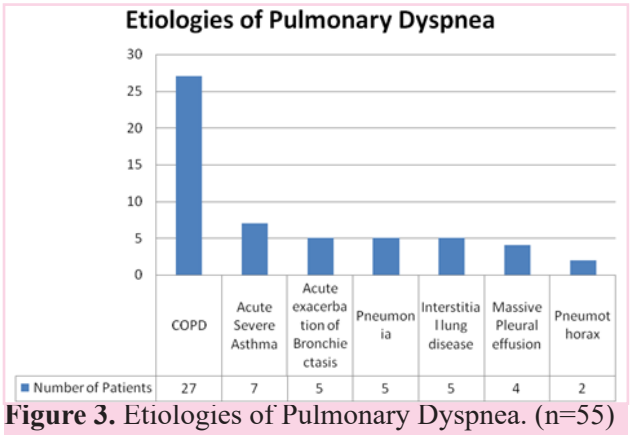

Figure 3. Etiologies of Pulmonary Dyspnea. (n=55)

Group C, consisted of 30 patients with both CCF and PD.

Levels of NT-proBNP were compared among three groups.

Our data showed that NT-proBNP levels in group B were significantly lower than those in groups A and C. NT-proBNP of (275±70) ng/l in group B patients vs. (1300±175) ng/l in group A vs. (1276±165) ng/l in group C patients. NT-proBNP levels among patients with cardiac dyspnea were significantly higher than those among patients with only pulmonary dyspnea (Table 1).

Table 1. Baseline characteristics of patients who had dyspnea.

Group	Group A/Cardiac Dyspnea (n=65)	Group B/Pulmonary Dyspnea (n=55)	Group C/Mixed Dyspnea (n=30)
Hypertension	15(23%)	15(27%)	11(36.6%)
Diabetes	13(20%)	9(16%)	12(40%)
Orthpnoea	55(84%)	0	27(49%)
Elevated Jugular venous pressure	30(46.1%)	25(45%)	14(46.6%)
LV Ejection Fraction% (mean)	34.7	65	46
Serum Creatinine (mean/mg/dl)	1.3	1.2	1
NT-proBNP (mean± SD)	(1300±175) ng/l	(275±70) ng/l	(1276±165) ng/l

Among the patients in groups A and C, the NYHA functional class of symptoms were positively correlated to the level of NT-proBNP. Alsohigher NT-proBNP level is associated with lower LVEF value and poor cardiac function (Table 2).

Table 2. NT-proBNP levels and LVEF values in patients correlated with NYHA functional Class.

NYHA Classification	NT-proBNP (ng/L)	LVEF (%)
Class II (n=40)	465.78 ± 50	55±5
Class III (n=30)	900.89 ±45	45±8
Class IV (n=10)	2900.98 ±76	40±7

DISCUSSION

As a common clinical condition seen in the ER, dyspnea frequently has a non-specific cause and is worsened by other illnesses. To achieve the better patient outcomes, accurate diagnosis is crucial for both pulmonary and cardiac causes of dyspnea as they have high morbidity and mortality. Echocardiography, a common but expensive tool which requires expertise to evaluate functioning of the heart, may have limited utility in emergency departments. Furthermore, it is difficult to maintain proper placement of patients with severe symptoms which may affect the result of the test. Aspecific and rapid test is thus of utmost important while managing the case of dyspnea with reducing the mortality rate. BNP, which functions by promoting natriuresis and inhibiting the sympathetic and renin-angiotensin-aldosterone systems, is a peptide hormone released in response to an increase in ventricular volume or pressure overload by the cardiomyocytes. The more stable and nonfunctioning form, NT-proBNP that is catalyzed from Pro-BNP is useful indicator in monitoring the changes in the left ventricle pressure and tension.[12, 13] In a study done by Shaikh K et al.[14], the mean NT-proBNP level among the 79 subjects with a final diagnosis of heart failure was 10918 compared with 461 pg/ml in those without heart failure (p=0.001). This was similar in our study where NT-proBNP was (1300±175) ng/l in group A and (1276±165) ng/l in group C patients which comprised of the diagnosis of Cardiac dyspnea due to heart failure and mixed dyspnea due to cardiac and pulmonary causes respectively, the value of NT-proBNP was (275±70) ng/l in those with only pulmonary cause of dyspnea. Another statistically significant result in those with cardiac and noncardiac acute dyspnea in terms of NT-proBNP was seen in study by Qin Su et al.[15] NT-proBNP levels in pulmonary dyspnea were significantly lower than those in congestive heart failure and mixed-pulmonary dyspnea and congestive heart failure,

[(186.4±69.5) vs. (1739.2±771.5) and (1837.4±874.6) ng/L, $P<0.01$). This study also demonstrated no significant difference between group A (cardiac dyspnea) versus (mixed dyspnea) (1739.2±771.5) versus (1837.4±874.6) as in our study (1300±175) ng/l versus (1276±165) ng/l. In contrast Muller et al. demonstrated non significance of NT-pro BNP and BNP levels when compared to diagnose the cardiac cause of dyspnea,[16] however our study focuses on the utility of NT-proBNP only for the diagnosis of cardiac cause of dyspnea in acute setting. Our study also gave the evidence that the cardiac dyspnea and mixed dyspnea patient had higher levels of NT-proBNP than the pulmonary dyspnea alone. Although less in number, the NYHA class IV patients had very high NT-proBNP levels than rest of the NYHA class. There was also a display of poorer left ventricular function in echocardiography as per the increment of NT-proBNP levels as well as the NYHA class as shown by Belgavi et al., where among 100 patients, 17% with moderate LV dysfunction with EF 30–39% had mean NT proBNP of 2092.35, and 19% with severe LV dysfunction with EF > 30% had a mean NT proBNP of 2763.95 pg/mL.[1] It was seen that the NT proBNP levels increased significantly as the severity of LV systolic dysfunction increased. This was similar in our study where as expected in cardiac dyspnea with mean ejection fraction of 34.7% had NT-proBNP of 1300±175 ng/l, and those with pulmonary dyspnea and mean ejection fraction of 65% had NT-proBNP level of 275±70 ng/l.

CONCLUSION

A quick NT-proBNP test at the patient's bedside can help with differential diagnosis in patients experiencing acute dyspnea, and more so for differentiation of cardiac and pulmonary causes resulting in improved, effective and efficient management.

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