ORIGINAL RESEARCH PAPER

Pulmonary Medicine

ROLE OF NT-PRO BNP AND 2D-ECHO TO EXCLUDE HEART FAILURE IN CASE OF ACUTE EXACERBATION OF COPD (AECOPD)

KEY WORDS: AECOPD (Acute exacerbation of Chronic Obstructive Pulmonary Disease), Heart Failure,NT-proBNP,2D-Echocardiogram.

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ABSTRACT

Co-existing heart failure and AE-COPD may present as a diagnostic challenge, because of the frequent overlap amongst their signs and symptoms like exertional breathlessness, cough and paroxysmal nocturnal dyspnoea. The objective of the present study was to test the hypothesis that NT-pro-BNP and 2D-Echo can exclude heart failure in patients of AE-COPD. A prospective, hospital based single-centered study conducted in the department of Pulmonary Medicine at Gauhati Medical College & Hospital, Guwahati in a total of 96 patients hospitalized for AE-COPD. Clinical, biochemical data, serum NT-proBNP levels and 2D-Echocardiogram were recorded in all patients.2D-Echo was considered as gold standard for diagnosing heart failure. Cut-off level of NT-proBNP for diagnosing heart failure was taken> 500pg/ml and was compared with 2D-Echo.

INTRODUCTION:

In present day to day scenario, COPD has become one of the major cause of increasing mortality and morbidity. According to a global survey conducted recently, by 2020 this condition shall become the third most frequent cause of death, following coronary and cerebro-vascular disease.[1] In India, COPD associated death rate has been found to be highest in comparison to other nations worldwide.[2]

The main etiology behind COPD in industrialized countries is tobacco smoke and in case of low-income countries it is air pollution and indoor biomass fuel consumption.[3]

A COPD exacerbation is generally defined as "an acute worsening of respiratory symptoms that result in additional therapy. [4] These exacerbations are classified as mild, moderate or severe depending on the intensity of medical interventions done in order to bring the related signs and symptoms under proper control.

Acute heart failure is defined as the rapid onset of signs and symptoms secondary to abnormal cardiac function. [5] Acute decompensated heart failure usually manifests as acute respiratory distress which is a serious medical condition. Elevated levels of both serum B-type natri-uretic peptide (BNP) and the N-terminal fragment of pro-BNP (NT-proBNP) are considered as important diagnostic biomarkers of heart failure.[6] So, even in case of heart failure associated with AE-COPD, these natri-uretic peptide levels will be elevated.

NT-proBNP is mainly a hormone having the pharmacological actions of diuresis and vasodilatation, which is mainly released in response to the strain by the cardiac myocytes, located in the left ventricle(occasionally also released from right ventricle in conditions like cor-pulmonale etc). It acts by reducing the marked increase in pressure and volume overload of both the ventricles of an already de-compensated heart.[7,8,9,10]

The NT-proBNP cut-off level for diagnosing acute heart failure varies widely with age [11]:

a) If age is <50 years, then cut-off range is <450 pg/ml
b) If age is 50-75 years, then cut-off range is <900 pg/ml
c) If age is >75 years, then cut-off range is <1800 pg/ml

The term "Heart Failure" in broad spectrum includes a syndrome comprising of mainly functional and morphological changes in heart owing to various etiologies and all these changes are apparent from a very essential diagnostic tool "2D-Echocardiography".

NT-proBNP provides information regarding ventricular/ atrial wall stress and pressure, monitors efficacy of ongoing therapy as well as helps in assessing prognosis and underlying compensation and decompensation of cardiac function.

2D-Echocardiography provides all essential data regarding cardiac structure and performance, determines etiology of heart failure, quantifies abnormality of cardiac function and finally helps in choosing specific treatment protocol for each specific patient and thereby keeps a track of prognosis even.[12,13]

Therefore, 2D-Echo has been considered as the gold standard for diagnosing heart failure worldwide.

With this aim, the present study has been planned to determine the role of NT-proBNP and 2D-Echo in excluding heart failure in patients of AE-COPD.

MATERIALS AND METHODS:

This was a prospective, hospital based single-centre study conducted from Nov.2016 to Oct.2017 in the Dept. of Pulmonary Medicine, Gauhati Medical College and Hospital after taking approval from Institutional Ethical Committee.

A total of 96 patients with the diagnosis of AECOPD were analysed during our entire study period. All clinically diagnosed cases of COPD exacerbation irrespective of having heart failure were included in our study.

Demographical, clinical, biochemical parameters along with serum NT-proBNP levels and 2D-Echocardiogram were recorded in each patient. The identity of the patients was kept confidential throughout the study.

Cut –off value of NT-proBNP for diagnosing heart failure in our study was taken >500 pg/ml. But for exclusion of heart failure, 2D-Echo was considered as gold standard.

The following were the exclusion criteria followed in our study:
a) Patients not willing for consent.
b) Haemodynamically unstable patients.
c) Patients diagnosed with other known respiratory tract disorders
d) Those patients who had undergone previous lung surgery

e) Previously diagnosed cases of heart failure The entire data was analysed using descriptive statistics.

RESULT:

In this study, a total of 96 AECOPD patients were taken. Out of these 96 patients, 61 patients were diagnosed with heart failure on the basis of 2D-Echocardiogram.

Total 54 patients had elevated NT-proBNP (>500pg/ml), amongst which 48 patients were diagnosed with heart failure on the basis of the gold standard diagnostic tool 2D-Echocardiogram (as depicted in figure 1).Rest 6 cases of raised NT-proBNP levels were probably due to the presence of medical conditions like sepsis, hypertension and diabetes mellitus

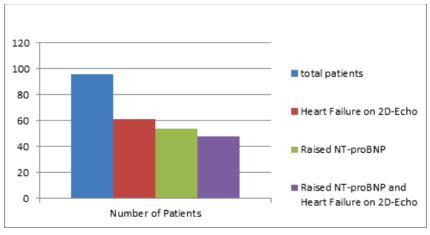

Figure 1: Showing no. of patients in the study under different clinical conditions

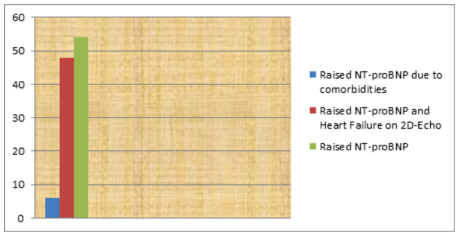

Figure 2: Different conditions of raised NT-proBNP level

Out of 96 patients, 51 were male and 45 were female with male/female ratio of 1.13. 35 female patients were diagnosed with heart failure on the basis of 2D-Echo, out of which 32 females had raised NT-proBNP level. 26 male patients were diagnosed with heart failure on the basis of 2D-Echo out of which 16 males also had associated raised NT-proBNP level. So, it was found that female patients with heart failure were more commonly associated with elevated levels of NT-proBNP (91.42%) in comparison to male counterparts (61.54%).

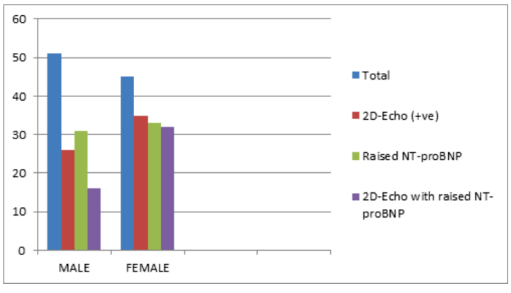

Figure 3: Showing the demographic profile of the study

The sensitivity and specificity of NT-proBNP for detecting heart failure in AE-COPD patients was 88.89% and 69.04% respectively.

NT-proBNP	>500 pg/ml	<500 pg/ml
2D-Echo (positive)	48	13
2D-Echo(negative)	6	29

Table 1: Showing true positive, true negative, false positive &false negative cases of heart failure in AECOPD patients with raised /not raised NT-proBNP level

Out of 54 raised NT-proBNP level cases, 7 patients had LVEF<50%(12.96%) and rest all had preserved LVEF>50%(87.03%). The most common age group associated with heart failure and raised NT-proBNP was found to be 51-60 years (54.16%) followed by 61-70 years (29.16%) and 40-50 years (16.67%).

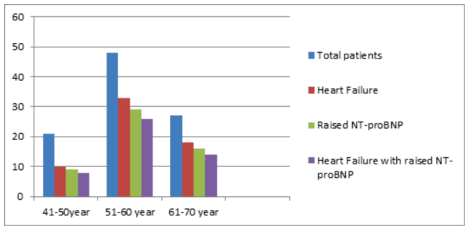

Figure 4: Age -wise distribution of patients in different clinical conditions

In case of few patients with raised NT-proBNP level and normal 2D ECHO in our study, some co-morbidities were found to be associated. Amongst which sepsis had the closest association (77.77%) followed by hypertension (72.22%) and diabetes (38.88%).

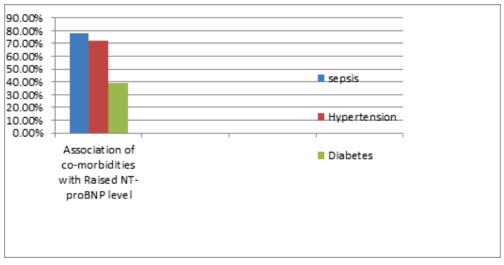

Figure 5: Association of different co-morbidities with raised NT-proBNP level

DISCUSSION

Co-existing heart failure and AECOPD presents as a diagnostic challenge because of frequent overlap amongst their signs and symptoms

In our study, we found that patients of AECOPD suffering from Heart failure at the same time, serum NT-proBNP level become elevated. Similar type of findings of raised serum NT-proBNP level in AECOPD patients with Heart Failure have been found in a study conducted by Alice Buchan et al [14]

There was an exceptional finding in our study in which 6 AECOPD cases had raised NT-proBNP levels but were not associated with Heart Failure rather were found to be associated with co-morbidities like sepsis, hypertension and diabetes. A similar type of a slight increase in serum NT-proBNP level has been observed in few patients with AECOPD without heart failure in a study conducted by Nishimura K et al [15].

2D-Echocardiography is the confirmatory diagnostic tool for Heart Failure. It is of utmost help in diagnosing heart failure in patients with intermediate NT-proBNP levels.[16]

The American College of Cardiology/American Heart Association guidelines have now approved echocardiography as the gold standard diagnostic and prognostic tool for Heart Failure. These recent guidelines have also emphasized on the utility of 2D-Echo in determining morphological and functional changes of different heart chambers in heart failure as well as in identifying the etiology of heart failure and starting the proper treatment.[17]

Our study results have highlighted upon the fact that concentrations of serum NT-proBNP increases with increasing age and decreasing LVEF (<50%).In a study conducted by M Bay et al, the same fact was established [18].Campbell et al described an age related co-relation of NT-proBNP in 33 healthy women in their study[19].Hunt et al found a significant co-relation between age and concentration of both BNP and NT-proBNP amongst patients with an LVEF<=45% [20].

Sanchez- Marteles M et al established the fact that COPD patients

present with high serum levels of NT-proBNP during acute exacerbations and these are modified with age and atrial fibrillation[21]

Arne Didrick Hoiseth et al found 24% of NT-proBNP measurements were above 1800pg/ml and 18% were above 2500 pg/ml, indicating a high probability of concomitant left heart failure in 20-25% of AECOPD admissions[22].

So our study strongly suggests that raised serum NT-proBNP levels indicates heart failure in AECOPD patients which is confirmed by 2D-Echocardiography.Thus NT-proBNP and 2D-Echo are very helpful diagnostics for health care professionals to exclude heart failure in patients with AECOPD.

CONCLUSION

In our study patients with AECOPD, those with elevated NT-proBNP levels had higher likelihood of being diagnosed with heart failure.

Echocardiography is considered as gold standard for the diagnosis of heart failure and for establishing an association between AECOPD, Heart Failure and elevated NT-proBNP levels. This can help in early and proper diagnosis of Heart failure in AECOPD patients, which will result in appropriate and early medical interventions, and thus reducing the mortality and morbidity ratios of these patients. More such larger prospective studies needs to be conducted in order to validate and assess if any direct co-relation exists between NT-proBNP level,2D-Echo and Heart Failure in AECOPD patients.

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