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Study of N-Terminal Pro B-Type Natriuretic Peptide as a Predictor of Severity in Patients with Community Acquired Pneumonia

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Abstract

Background: Pneumonia can affect people of all ages and is a major public health problem worldwide. The present study was undertaken for assessing the role of NT- PRO BNP as predictor of severity in patients with community acquired pneumonia. **Materials & methods:** A total of 100 patients with confirmed diagnosis of CAP were enrolled in the present study. Chest X ray/ CT scan was used for confirming the diagnosis. NT- pro BNP levels were measured within the first 72 hours of hospitalization at the emergency department. Pneumonia severity index (PSI) was calculated. All the results were recorded in Microsoft excel sheet and were analyzed by SPSS software. **Results:** Mean NT-pro BNP levels were found to be 1321.91 ng/L. Mortality was seen in 16 percent of the patients. Mean NT-pro BNP levels among patients of grade , Grade 2, Grade 3, grade 4 and Grade 5 PSI was found to be 469.5 ng/L, 1077.64 ng/L, 1042.74 ng/L, 1269.07 ng/L and 3028 ng/L respectively. While analysing statistically, significant results were obtained. NT-pro BNP among the patients of the survivor group was 954.27 ng/L and was found to be significantly lower in comparison to the patients of the non-survivor group (3252 ng/L). NT-pro BNP among the patients with CURB-65 score of less than 3 was 1112.69 ng/L and was found to be significantly lower in comparison to the patients of the non-survivor group (2607.07 ng/L). While assessing the correlation of NT- pro BNP levels with ICU admission, significant results were obtained. **Conclusion:** NT-proBNP levels correlated with the clinical severity of the disease. Hence; NT-proBNP levels might be an effective parameter in predicting the disease course.

Key words: Pro B-Type Natriuretic Peptide, Community Acquired Pneumonia

INTRODUCTION

Pneumonia can affect people of all ages and is a major public health problem worldwide. It is a significant cause of mortality and morbidity, especially in children under five years of age and in older adults. Community acquired pneumonia (CAP) is defined as pneumonia acquired outside the hospital by an immune-competent individual.[1- 3]

Brain natriuretic peptide (BNP) is a potent natriuretic and diuretic hormone that is released from the heart into the systemic circulation and is enzymatically cleaved into active and inactive forms-BNP and N-terminal pro-brain natriuretic peptide (NT-proBNP), respectively. Pro-B-type natriuretic peptide (BNP) is a prohormone secreted in response to myocardial stretch, volume overload and elevated end-diastolic pressure from cardiac myocytes. N-terminal pro-B-type natriuretic peptide (NT-proBNP) is a 76 amino acid peptide produced by the cleavage of proBNP into an active BNP and an inactive NT-proBNP. NT-proBNP appears to have a longer half-life and fewer preanalytic issues than those seen with BNP. Both peptides have been used in the assessment and prognosis of congestive heart failure, myocardial infarction, pulmonary embolism and sepsis.[4- 6]Hence; under the light of above mentioned data, the present study was undertaken for assessing the role of NT- PRO BNP as predictor of severity in patients with community acquired pneumonia.

MATERIALS & METHODS

The present study was conducted with the aim of assessing the role of NT- PRO BNP as predictor of severity in patients with community acquired pneumonia. A total of 100 patients with confirmed diagnosis of CAP were enrolled in the present study. Chest X ray/ CT scan was used for confirming the diagnosis. NT- pro BNP levels were measured within the first 72 hours of hospitalization at the emergency department. Pneumonia severity index (PSI) was calculated. Inclusion criteria for the present study included:

- Patients who gave informed consent,
- Patients more than 18 years of age,
- Patients who had consolidation on chest X ray/ CT scan along with at least two of the following criteria:
    - Fever
    - Cough with sputum/dyspnea

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- Increased WBC
- Acute respiratory failure/worsening of hypoxemia

All the results were recorded in Microsoft excel sheet and were analyzed by SPSS software. Chi- square test, One way ANOVA and student t test were used for evaluation of level of significance.

RESULTS

Mean age of the patients was 57.95 years. 68 percent of the patients were males while the remaining 32 percent were females. 39 percent and 38 percent of the patients were of grade 4 and grade 3 according to PSI. Mean SBP and DBP was 129.24 and 74.58 mm of Hg respectively. Mean PR and RR was 105.03 and 23.79 respectively. Mean Hb concentration was 11.84 g/dL. Mean WBC concentration was 13.82 x 10^9/cu mm. Mean pCo_2 and mean pO_2 was found to be 35.21 and 67.56 respectively. Mean HCO_3 concentration was found to be 21.84mEq/L. Cough, Sputum and dyspnoea was present in 16 percent, 75 percent and 78 percent of the patients respectively. 50 percent of the patients had CURB-65 score of 1, while 36 percent of the patients and 13 percent of the patients had CURB-65 score of 2 and 3 respectively. Mean NT-pro BNP levels were found to be 1321.91 ng/L. Mortality was seen in 16 percent of the patients. Mean NT-pro BNP levels among patients of grade , Grade 2, Grade 3, grade 4 and Grade 5 PSI was found to be 469.5 ng/L, 1077.64 ng/L, 1042.74 ng/L, 1269.07 ng/L and 3028 ng/L respectively. While analysing statistically, significant results were obtained. NT-pro BNP among the patients of the survivor group was 954.27 ng/L and was found to be significantly lower in comparison to the patients of the non-survivor group (3252 ng/L). NT-pro BNP among the patients with CURB-65 score of less than 3 was 1112.69 ng/L and was found to be significantly lower in comparison to the patients of the non-survivor group (2607.07 ng/L). While assessing the correlation of NT- pro BNP levels with ICU admission, significant results were obtained.

Table 1: Distribution of patients according to PSI grade

PSI	Number of patients	Percentage
1	2	2
2	11	11
3	38	38
4	39	39
5	10	10
Total	100	100

Table 2: Distribution of patients according to CURB-65 score

CURB-65	Number of patients	Percentage
0	0	0
1	50	50
2	36	36
3	13	13
4	1	1
Total	100	100

Table 3: NT-pro BNP levels

Parameter	Mean	SD
NT-pro BNP (ng/L)	1321.91	1141.86

Table 4: Mortality

Mortality	Number of patients	Percentage
Yes	16	16
No	84	84
Total	100	100

Table 5: Correlation of severity of community acquired pneumonia (PSI grade) and NT-pro BNP levels

PSI grade	NT-pro BNP levels		p- value
	Mean	SD	
1	469.5	174.68	0.000*
2	1077.64	646.24	
3	1042.74	658.44	
4	1269.07	946.74	
5	3028.00	2120.92	

*: Significant

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Graph 1: Correlation of NT-pro BNP levels and mortality in patients with community acquired pneumonia

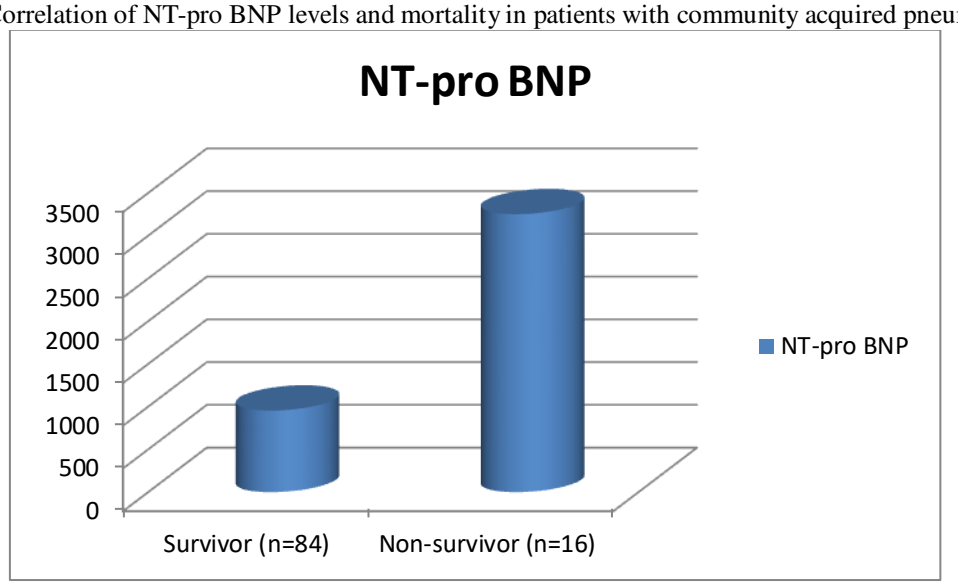

Table 6: Correlation of CURB-65 grading and NT-pro BNP levels in patients with community acquired pneumonia

Variable	CURB- 65 score Less than 3		CURB- 65 score ≥3		p- value
	Mean	SD	Mean	SD	
NT-pro BNP levels	1112.69	836.59	2607.07	1812.41	0.000

Table 7: Correlation of NT- proBNP levels and ICU admission

Parameter	ICU admission				p- value
	Yes (n=24)		NO (n=76)		
	Mean	SD	Mean	SD	
NR- proBNP levels	2112.20	1614.89	1072.34	811.87	0.0001*

*: Significant

DISCUSSION

Despite recent developments in clinical care and antimicrobial treatment, pneumonia continues to be a leading cause of mortality worldwide, especially in the elderly. In cases of community-acquired pneumonia (CAP), the Pneumonia Severity Index (PSI) and the Confusion, Urea, Respiratory rate, Blood pressure, and age ≥ 65 years (CURB-65) score are used in order to predict the severity and determine the prognosis. However, calculating risk scores, especially the PSI, is complex and is dependent on subjective impressions, which can lead to errors in clinical practice. Brain natriuretic peptide (BNP) is a potent natriuretic and diuretic hormone that is released from the heart into the systemic circulation and is enzymatically cleaved into active and inactive forms-BNP and N-terminal pro-brain natriuretic peptide (NT-proBNP), respectively. The optimal timing of NT-proBNP assessment for risk stratification is unclear.[7- 9]Hence; under the light of above mentioned data, the present study was undertaken for assessing the role of NT- PRO BNP as predictor of severity in patients with community acquired pneumonia.

A total of 100 patients with community acquired pneumonia were enrolled. Mean NT-pro BNP levels were found to be 1321.91 ng/L. Mean NT-pro BNP levels in a study conducted by Mueller C et al were found to be 170 ng/L. Mortality was seen in 14 percent of the patients.[7] Variable results have reported in the past literature in this context. Mortality was seen in 20 percent of the patients in the study conducted by Akpinar EE et al. In another study conducted by Huang X et al, mortality rate was 55.1 percent.[8, 9] Mortality rate was 10.5% in another previous study conducted by Varela T et al. [10]

Mean NT-pro BNP levels among patients of grade , Grade 2, Grade 3, grade 4 and Grade 5 PSI was found to be 469.5 ng/L, 1077.64 ng/L, 1042.74 ng/L, 1269.07 ng/L and 3028 ng/L respectively. While analysing statistically, significant results were obtained. our results were in concordance with the results obtained by previous authors who also reported similar findings. Martolini D et al, in their study, reported significant correlation between NT-proBNP levels and grades of PSI. In another study conducted by Akpınar EE et al, authors reported that NT-proBNP level correlated significantly with the PSI.[8, 11]

The PSI is the most widely used and validated index for the risk classification of patients with CAP. It uses a three-step algorithm including demographics, the presence of relevant comorbidities, and findings on physical examination, vital signs and various laboratory findings to stratify CAP patients into five risk categories. This

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prediction rule was initially invented to aid physicians in selecting patients suitable for outpatient treatment (Fine MJ et al). Hence, potential of BNP to predict treatment success and cure with similar power as the PSI is especially impressive.[8- 10]

Li et al confirmed that BNP could be used as a biomarker for evaluating the severity of CAP. They recommended BNP level of 299.0 pg/mL in predicting in-hospital mortality.[12]NT-pro BNP among the patients of the survivor group was 954.27 ng/L and was found to be significantly lower in comparison to the patients of the non-survivor group (3252 ng/L). Our results were in concordance with the results obtained by previous authors who also reported similar findings in their respective studies. HyewonS et al, in their study, reported that NT-proBNP levels were significantly higher in the non-survivor group than in the survivor group.In a study conducted by Jeong KY et al, mean NT-proBNP levels among the patients of non-survivor group were 3211 ng/L and were significantly higher in comparison to survivor group (966.5 ng/L) They concluded that NT-proBNP was an independent predictor of mortality.[13, 14]

CONCLUSION

NT-proBNP levels correlated with the clinical severity of the disease. Hence; NT-proBNP levels might be an effective parameter in predicting the disease course.

REFERENCES

1. GBD 2016 Lower Respiratory Infections Collaborators Estimates of the global, regional, and national morbidity, mortality, and aetiologies of lower respiratory infections in 195 countries, 1990-2016: A systematic analysis for the Global Burden of Disease Study 2016. Lancet Infect. Dis. 2018;18:1191–1210.
2. Kolditz M, Ewig S. Community-Acquired Pneumonia in Adults. DtschArztebl Int. 2017;114(49):838-848.
3. Regunath H, Oba Y. Community-Acquired Pneumonia. [Updated 2019 Dec 24]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2020 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK430749/
4. Fernandez JF, Restrepo MI. Is N-terminal pro-B-type natriuretic peptide ready for 'prime time' in severe pneumonia?.Respirology. 2013;18(6):889-890. doi:10.1111/resp.12134
5. Fine MJ, Hanusa BH, Lave JR, Singer DE, Stone RA, Weissfeld LA, Coley CM, Marrie TJ, Kapoor WN. Comparison of a disease-specific and a generic severity of illness measure for patients with community-acquired pneumonia. J Gen Intern Med. 1995 Jul; 10(7):359-68
6. Zhang S, Zhang HX, Lin RY, Zhang SM, Xu ZY. Predictive role of NT-pro BNP for adverse cardiac events in community-acquired pneumonia: a retrospective study. Int J ClinExp Med 2016;9(7):14411-14417
7. Mueller C, Laule-Kilian K, Scholer A, Perruchoud AP. B-type natriuretic peptide for risk stratification in community-acquired pneumonia. J Intern Med 2005; 258: 391–3.
8. Akpınar EE, Hoşgün D, Akpınar S, et al. Do N-terminal pro-brain natriuretic peptide levels determine the prognosis of community acquired pneumonia?. J Bras Pneumol. 2019;45(4):e20180417.
9. Huang X, Zhang J, Huang X, He W, Zeng M, Chen Y. NT-pro-BNP as a predictor of 28-day mortality in critically ill patients with severe pneumonia. Crit Care Med 2015 • Volume 43 • Number 12: 40
10. Varela T, Cacho MM, Valle PA, Gallo-Terán H, Pérez-Mier J, Colomo-Mármol LA, Fernando L. The amino-terminal fragment of pro-brain natriuretic peptide in plasma as a biological marker for predicting mortality in community-acquired pneumonia: a cohort study. Eurasian J Emerg Med 2016; 15: 30-38
11. Martolini, D., Pistella, E., Carmenini, E., &Santini, C. (2017). NT-proBNP correlates with the illness scores pneumonia severity index and CURB-65 in patients with pneumonia. Italian Journal of Medicine, 11(1), 37. doi:10.4081/itjm.2017.728
12. Li J, Ye H, Zhao L. B-type natriuretic peptide in predicting the severity of community-ac¬quired pneumonia. World J Emerg Med 2015; 6: 131-136.
13. HyewonSeo, Ji-Eun Park, Sunji Park, Seung-Ick Cha. The role of N-terminal pro B-type natriuretic peptide in predicting mortality of community acquired pneumonia European Respiratory Journal 2019 54: OA3308;
14. Jeong, K. Y., Kim, K., Kim, T. Y., Lee, C. C., Jo, S. O., Rhee, J. E., … Singer, A. J. (2010). Prognostic value of N-terminal pro-brain natriuretic peptide in hospitalised patients with community-acquired pneumonia. Emergency Medicine Journal, 28(2), 122–127. doi:10.1136/emj.2009.089383