



Spotlight on Special Topics

PREDICTING IN-HOSPITAL CLINICAL TRAJECTORIES USING MACHINE LEARNING IN PATIENTS ADMITTED WITH ACUTE DECOMPENSATED HEART FAILURE

Poster Contributions
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Background: Clinical trajectories of patients with decompensated HF during hospitalization are important for optimization of treatment, determination of readiness of discharge, and prognosis. We used machine learning to characterize patients hospitalized for HF who achieve a higher BNP/NT-proBNP reduction at discharge and predict the in-hospital trajectory using clinically available data in the first 48 hours of admission.

Methods: This study included patients admitted with HF at the Veteran Affairs healthcare system. Hospitalization records with both admission (collected within 24 hours of admission) and discharge BNP/NT-proBNP were included in the analysis. We tracked BNP-to-BNP and NT-proBNP-to-NT-proBNP changes. We randomly split the patients into training (80%) and test (20%) sets. We trained a recurrent neural network model based on the clinical data in the first 48 hours after admission to predict BNP/NT-proBNP reduction greater than 30% (responders) versus less than 30% (non-responders). We calculated the AUC of the AI model evaluated on the test set.

Results: We extracted 71,140 HF patient records, 4,711 of which had both admission and discharge BNP/NT-proBNP values (responders, $n = 2,742$, age, 71 ± 11 years; non-responders, $n = 1,969$, age, 73 ± 11 years). Median % BNP/NT-proBNP reduction at discharge was 38.66% (interquartile range, 9.72-61.99%). The AI model utilizing early clinical parameters within 48 hours of admission achieved an AUC of 0.68 (95% confidence interval, 0.65-0.71) in predicting whether a patient will be a responder or a non-responder at the time of discharge compared to admission. The clinical features included in the AI model that were most predictive of changes in BNP/NT-proBNP were heart rate, BUN, systolic blood pressure, renal failure, and body temperature.

Conclusion: An AI model utilizing clinical variables within the first 48 hours can predict BNP/NT-proBNP response at the time of discharge in patients hospitalized with acute decompensated HF. This study demonstrates the potential of leveraging AI to determine the clinical trajectory of a decompensated HF patient shortly after admission which may be crucial to plan therapy and interventions.