Deep Neural Network to Predict Progression From Mild to Severe Acute Kidney Injury

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Acute Kidney Injury (AKI) is a major clinical complication with an incidence of 50% among critical care patients and an observed in-hospital mortality of 62%. The early identification of patients at risk of progressing from AKI Stage 1 to AKI Stage 2/3 is vital for allowing clinical intervention prior to the onset of short-term and long-term complications. Few methods have been developed to predict AKI progression or recovery trends, with available methods only predicting recovery from or progression to chronic kidney disease (CKD) or end-stage renal disease (ESRD). The objective and novelty of this study was to proactively determine patient recovery from AKI Stage 1 or progression to AKI Stage 2/3 following a Stage 1 onset using machine learning prediction models, thus enabling early clinical intervention and better usage of critical hospital assets. A deep learning neural network (DLNN) model was constructed and established models were evaluated by cross-validation, Receiver Operating Characteristics (ROC), Precision-Recall Curves (PRC), Sensitivity, and Specificity. Blood urea nitrogen (BUN) and glomerular filtration rate (GFR) were the most important features in AKI progression or recovery prediction as identified by Area Under the Curve (AUC) metric. The model performed at an AU-ROC of 0.87 and at two decision thresholds had a Sensitivity of 82.5% and Specificity of 83.7% respectively. These findings indicate that electronic health-record data can be used to predict AKI progression or recovery. Furthermore, the real-time use of this model would allow early intervention for patients at risk of moderate-to-severe AKI.