

# Features of Arterial Blood Pressure as Indicators of Impending Acute Kidney Injury in ICU Patients

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In the context of critical illness, hypotension may be associated with acute kidney injury (AKI). We studied the relationship between arterial blood pressure and the development of AKI using the MIMIC II Database (release v2.4). We defined AKI as an increase in creatinine of at least 50%, to 1.2 mg/dL or more, within a period of 12 - 48 hours.

Among the 17,202 adult ICU stays that had at least 3 creatinine measurements without elevated ( $>5$  mg/dL) admission creatinine, AKI occurred in 1,506 (8.75%) of these cases. The remaining 15,696 cases were identified as the controls. Nurse-verified systolic intra-arterial blood pressure (SBP) measurements obtained at intervals of an hour or less, were recorded for approximately 80% of the AKI cohort, and 45% of the controls.

We examined six features of the SBP time series for each ICU stay, including minimum, median, fractions of samples below 90 and 110 mmHg, and mean and minimum sample-to-sample differences. We calculated each feature using SBP samples for up to four 24-hour windows (beginning at 24, 48, 72, and 96 hours) before T, where T was defined as either the time when the AKI criterion was met, or (for controls) the time of the penultimate creatinine measurement.

Significant differences between the AKI cohort and controls emerge as early as the third day before AKI onset. Using Student's t-test, we found significantly lower median and minimum SBP values in the AKI cohort ( $p < 0.0009$  and  $p < 0.0017$  respectively) over the period from 72 to 48 hours before T. There is a significantly higher fraction of SBP less than or equal to 110 mmHg in this time window for the AKI cohort ( $p < 0.0004$ ). Our results suggest that patterns in intra-arterial blood pressure may contain useful features in developing early warning signs of AKI.