



Shaping Tomorrow's Nephrology: Insight-Driven Kidney Care

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Predicting Circuit Longevity in CRRT: A Machine Learning Analysis of Regional Citrate Anticoagulation and Calcium Gradients

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Objectives : This study aimed to enhance the use of regional citrate anticoagulation (RCA) during continuous renal replacement therapy (CRRT) by examining how post-filter calcium levels affect circuit longevity. RCA is the standard anticoagulation method for critically ill patients on CRRT, but the ideal target for post-filter ionized calcium to extend filter life is unclear.

Methods : We analyzed 1,075 CRRT sessions from an intensive care unit, dividing them into two groups based on post-filter calcium gradient: a lower target range (0.25-0.35 mmol/L) and a higher range (0.35-0.50 mmol/L). We compared circuit lifespan, patient demographics, and lab values between groups and employed machine learning algorithms (including Random Forest, XGBoost, LightGBM, and SVM) to predict calcium gradient groups and circuit survival.

Results : The results showed that circuits managed with the lower calcium target lasted significantly longer—an average of 57.8 hours compared to 48.5 hours with the higher target, equating to a 16% increase in lifespan. A Random Forest model accurately predicted the calcium gradient group 82.8% of the time and accounted for 58.8% of the variability in predicting circuit lifetime. Key predictors for the calcium gradient included early post-filter calcium levels, platelet count, and initial blood pH, while coagulation events were the strongest predictor of circuit failure.

Conclusions : In conclusion, targeting a post-filter calcium level between 0.25-0.35 mmol/L is linked to markedly longer CRRT circuit survival. Machine learning models offer a reliable tool for personalizing anticoagulation management by predicting both calcium levels and circuit durability, supporting a shift toward lower, safe calcium targets in clinical protocols.

Fig 1.png



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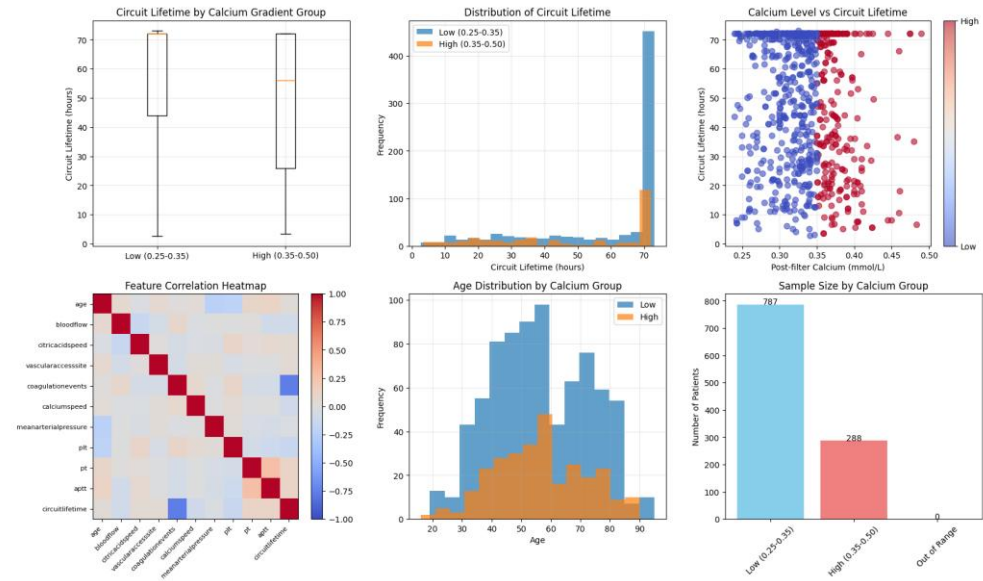


Fig 1.png

