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Beyond Challenges, Towards Healthier Kidney

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Deep Learning-Based Causal Inference with Multiple Treatments for Optimal ARB/ACEi Management Strategies in ICU-Admitted Patients with Sepsis

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Objectives : To assess the impact of different Angiotensin-Converting Enzyme inhibitors (ACEi) and Angiotensin Receptor Blockers (ARB) strategies on outcomes in Intensive Care Unit (ICU)-admitted sepsis patients using a deep learning-based causal inference approach.
Methods : We retrospectively analyzed 30,397 sepsis patients from the Medical Information Mart for Intensive Care IV (MIMIC-IV) database. Patients were grouped by ACEi/ARB use relative to sepsis onset (no use, early discontinuation, late discontinuation, and continuation). A deep learning-based causal inference model (adapted from DragonNet) estimated average treatment effects (ATEs) on in-hospital mortality, kidney outcomes, hyperkalemia, and prolonged ICU stay. SHapley Additive exPlanations (SHAP) analysis identified key predictors influencing treatment effects.
Results : Continuation of ACEi/ARB therapy was associated with the greatest reduction in in-hospital mortality (ATE: –7.12%) compared to no use, while early and late discontinuation produced mortality reductions of –5.39% and –4.23%, respectively. Kidney outcomes improved most with continuation (ATE: –0.52%), versus –0.37% and –0.34% with early and late discontinuation. However, continuation increased the risk of hyperkalemia (ATE: +0.95%) and was linked to a longer ICU stay (ATE: +1.35%). SHAP analysis revealed that lower baseline kidney function, chronic kidney disease, and diabetes were significant predictors of these effects, suggesting that patients with impaired renal function might benefit more from discontinuation strategies.
Conclusions : These findings support maintaining ACEi/ARB therapy in select septic ICU patients for improved survival and kidney protection, though increased hyperkalemia risk necessitates careful patient selection and monitoring. Personalized ACEi/ARB management may optimize sepsis treatment outcomes.

Figure 1.jpg

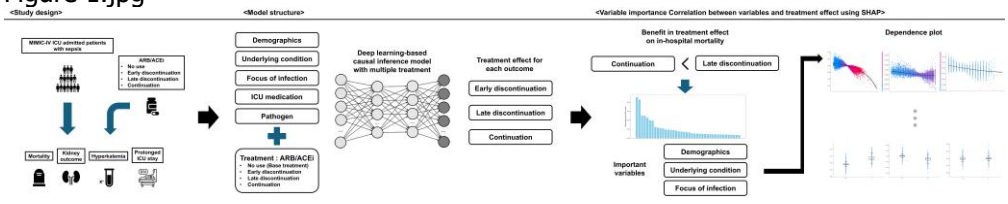

Figure 1.jpg

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