RT-P-006
Clinical Safety Analysis of Incompatible Disposables in Continuous Renal Replacement Therapy

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Objective

Optimal delivery of CRRT relies on an integrated system in which machines, compatible tubing, filters, and fluids operate synergistically to ensure precise pressure monitoring, anticoagulation, and fluid management. Using incompatible disposables (e.g., dialysis filters/tubing not validated for the specific CRRT machine) disrupts this integration. This review analyzes the safety risks associated with incompatible disposables in CRRT.

Materials & Methods

For this review, we systematically searched several major medical databases, including PubMed, Embase, and the Cochrane Library, and integrated relevant expert consensus statements, clinical guidelines, and the technical specifications of mainstream CRRT systems. The identified safety risks were subsequently categorized based on their clinical consequences and underlying mechanisms.

Results

The use of incompatible disposables significantly compromises the safety and efficacy of CRRT

Pressure Monitoring Disruption:

The use of incompatible tubing and filters can lead to several technical issues, including inaccurate pressure calibration, aberrant pressure drops, and persistent alarms. These complications subsequently delay treatment initiation, increase staff workload, and reduce effective therapy time.

Increased Clotting Risk:

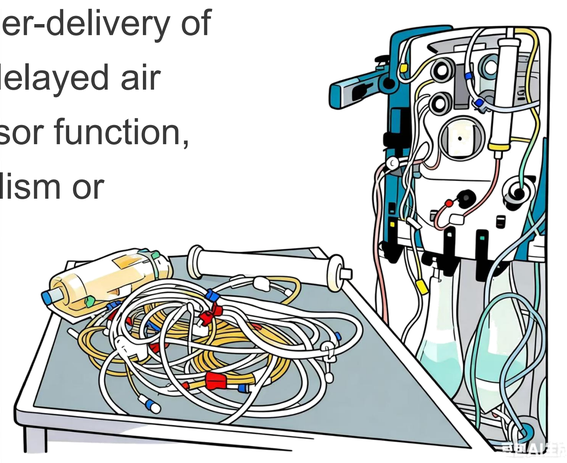
Using conventional hemodialysis dialyzers (designed for high flow HD mode) at typical CRRT flows reduces shear stress, promoting protein deposition and clotting. Incompatible tubing causes inaccurate blood flow rates, disrupting the precise dosing of citrate anticoagulation and increasing filter clotting. Consequences include blood loss, reduced filter lifespan, increased costs.

Fluid Management Errors:

The use of incompatible disposables impair the precise control of pumps, thereby jeopardizing accurate fluid balance. Consequently, this hinders the achievement of optimal fluid management, elevating the risk of adverse clinical outcomes such as volume overload or depletion.

Dose Delivery Failure & Safety Events:

Frequent alarms, clotting, and circuit changes reduce therapy time, leading to significant under-delivery of prescribed dose. Safety risks include delayed air detection and impaired blood leak sensor function, potentially increasing risks of air embolism or undetected blood loss.



Discussion and Conclusions

The use of incompatible disposables can compromise the integrity of CRRT system, leading to a range of complications. These include pressure instability, circuit clotting, fluid imbalances, inadequate dose delivery, and other safety hazards. Such complications adversely affect treatment efficacy, patient safety, and clinical outcomes. Therefore, the strict utilization of compatible disposables is imperative to ensure precise system function and the achievement of therapeutic goals.

References & Full Text available at: