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Fluid and Blood Pressure Management in Hemodialysis

Jin Ho Hwang

Chung-Ang University Hospital, Republic of Korea

Fluid overload and blood pressure (BP) dysregulation remain critical determinants of cardiovascular morbidity and mortality in hemodialysis (HD) patients. This presentation provides a comprehensive, evidence-based framework for contemporary fluid and BP management in the dialysis unit. Volume Assessment and Management: Accurate dry weight determination requires multimodal assessment combining clinical evaluation with technology-guided tools including bioimpedance spectroscopy (BIS/BCM), lung ultrasound, and relative blood volume monitoring. Meta-analyses demonstrate that overhydration $>1.1\text{L}$ independently predicts mortality, while BCM-guided therapy shows promising signals for reducing cardiovascular events. Ultrafiltration Optimization: High ultrafiltration rates (UFR $\geq 13\text{ mL/kg/h}$) are associated with increased all-cause (HR 1.56) and cardiovascular mortality (HR 1.71). Recent cohort studies emphasize that the proportion of high-UFR sessions, rather than average UFR alone, better predicts outcomes. Strategies include session extension, interdialytic weight gain (IDWG) reduction through sodium restriction, and conservative first-session prescriptions. Dialysate Sodium Management: The Cochrane 2024 review demonstrates that low dialysate sodium ($<138\text{ mM}$) reduces IDWG (MD -0.36 kg) and BP, but increases intradialytic hypotension (IDH) risk (RR 1.58) and cramping (RR 1.84). Individualized prescribing balancing benefits and risks is recommended. Intradialytic Hypotension Prevention: Evidence-based strategies include UFR moderation, cool dialysate therapy (MYTEMP trial: 70% IDH reduction), avoiding intradialytic meals, and optimized antihypertensive timing. Selective midodrine use may benefit refractory cases. Blood Pressure Management: Home BP monitoring demonstrates superior prognostic value over peridialytic measurements. A volume-first approach prioritizing ECV normalization before pharmacotherapy is fundamental. The CONVINCe trial (NEJM 2023) showed high-dose hemodiafiltration reduced all-cause mortality by 23% (HR 0.77).

Optimal HD fluid and BP management requires integrating clinical assessment, advanced monitoring technologies, individualized dialysis prescriptions, and patient-centered pharmacotherapy. This multimodal approach targeting the narrow therapeutic window between volume overload and depletion improves cardiovascular outcomes and quality of life.

Keywords: Fluid overload, blood pressure, hemodialysis, Volume, Ultrafiltration