Unravelling the relationship between mortality, hyponatremia, inflammation and malnutrition in hemodialysis patients: results from the international MONDO initiative

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Introduction

- Hyponatremia is a risk factor for mortality in hemodialysis patients.
- It is not well known to which extent the comorbidities, malnutrition, fluid status imbalance and inflammation are related to hyponatremia and affect outcomes.

Methods

- We studied 8883 patients from the European subset of the international MONitoring Dialysis Outcomes initiative.
- Nutritional and fluid statuses were assessed by bioimpedance spectroscopy.
- Fluid depletion was defined as overhydration ≤ -1.1L and fluid overload as overhydration > +1.1L, respectively. Malnutrition was defined as a lean tissue index below the 10th percentile of age- and gender-matched healthy controls.
- Hyponatremia and inflammation were defined as serum sodium levels < 135 mEq/L and C-reactive protein levels > 6.0 mg/L, respectively.
- We used logistic regression to test for predictors of hyponatremia and Cox proportional hazards analysis to assess the association with all-cause mortality.

Results

- Hyponatremia was predicted by the presence of:
  - malnutrition (odds ratio (OR) 1.50 (95% CI 1.31-1.71)
  - inflammation (OR 1.41 (95% CI 1.24-1.61))
  - moderate fluid overload ((> +1.1L to +2.5L) OR 0.86 (95% CI 0.76 0.65-0.89))
  - but neither severe fluid overload (> +2.5L) nor fluid depletion (OR 1.31 (95% CI 0.90-1.91))
  - Malnutrition, inflammation, fluid overload, fluid depletion and hyponatremia (hazard ratio 1.73 (95% CI 1.48-2.02)) were independent predictors for all-cause mortality.

Table 2. Predictors of Mortality

		95% CI	
	OR	lower	upper
Inflammation (CRP >6.0 mg/L)	1.44	1.26	1.64
Malnutrition (LTI < 10th percentile)	1.49	1.30	1.70
Fluid status pre-dialysis < -1.1L	1.34	0.92	1.96
Fluid status pre-dialysis +1.1L to +2.5L	0.73	0.62	0.85
Fluid status pre-dialysis +2.5L to +5.0L	0.79	0.65	0.94

Cox regression model adjusted for age, gender, dialysis vintage, dialysate sodium, region, access type (arterio-venous versus catheter access), body surface area, diabetes mellitus, congestive heart failure, cerebrovascular disease, peripheral vascular disease and the presence of malignancy

Conclusions

- In hemodialysis patients hyponatremia is associated with malnutrition, inflammation and mild fluid overload.
- Hyponatremia maintained predictive for all-cause mortality after adjustment for malnutrition, inflammation and fluid status abnormalities.
- The presence of hyponatremia may assist in identifying hemodialysis patients at increased risk of death.

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