HIGHER BICARBONATE DIALYSATE CONTENT WORSENS CARDIAC PERFORMANCE DURING HEMODIALYSIS SESSIONS

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BACKGROUND AND OBJECTIVE

Hemodialysis (HD) promotes profound alterations in a relatively short period of time, both by plasma ultrafiltration and diffusive clearance, which cause a transitory hypovolemic state and modifications in serum electrolyte concentration.

Bicarbonate buffer is used worldwide to correct acidosis in patients under HD. However, the deleterious effects of rapid alkalosis induction on the cardiovascular system as a consequence of this treatment are still unknown.

Objective: identify factors related to hemodynamic changes regarding dialysate prescription and patients' clinical characteristics through a non-invasive hemodynamic assessment (HA) method.

METHODS

In this prospective observational cohort we studied 30 end-stage renal disease (ESRD) patients on HD.

Patients receiving HD for at least 6 months, age ≥ 18 and < 65 years, who agreed to undergo hemodynamic assessment during HD sessions were enrolled in the study

Finger pulse contour analysis (Finometer monitor) was used to access hemodynamic parameters immediately pre and post HD sessions.

The differences between cardiac index (CI) and peripheral arterial resistance (PAR) post and pre-hemodialysis were expressed as ΔCI and ΔPAR, respectively. Na and K and were also expressed as the difference between serum and dialysate concentration (respectively, Na^+-GAP and K^+-GAP).

RESULTS

Table 1. Pre and post dialysis hemodynamic and biochemical variables

Variable	Pre HD	Post HD	p
Systolic Blood pressure (mmHg)	133.2 ± 23.8	121.9 ± 25.4	0.0003
Diastolic Blood pressure (mmHg)	74.5 ± 12.2	74.5 ± 13.6	0.990
Bicarbonate (mEq/L)	20.7 ± 3.4	29.6 ± 3.3	<0.0001
K^+ (mEq/L)	5.2 ± 0.5	3.8 ± 0.5	<0.0001
Stroke volume (ml)	90.0 ± 27.4	65.7 ± 29.0	<0.0001
Cardiac index (L/min/m²)	3.93 ± 0.89	3.20 ± 0.82	<0.0001
Peripheral arterial resistance (dyn.s/cm⁵)	1277 ± 431	1549 ± 632	0.0003

Figure 1. Spearman correlations between cardiac index variation and K^+gap (A), bicarbonate content (B) and Na^+ gap (C)

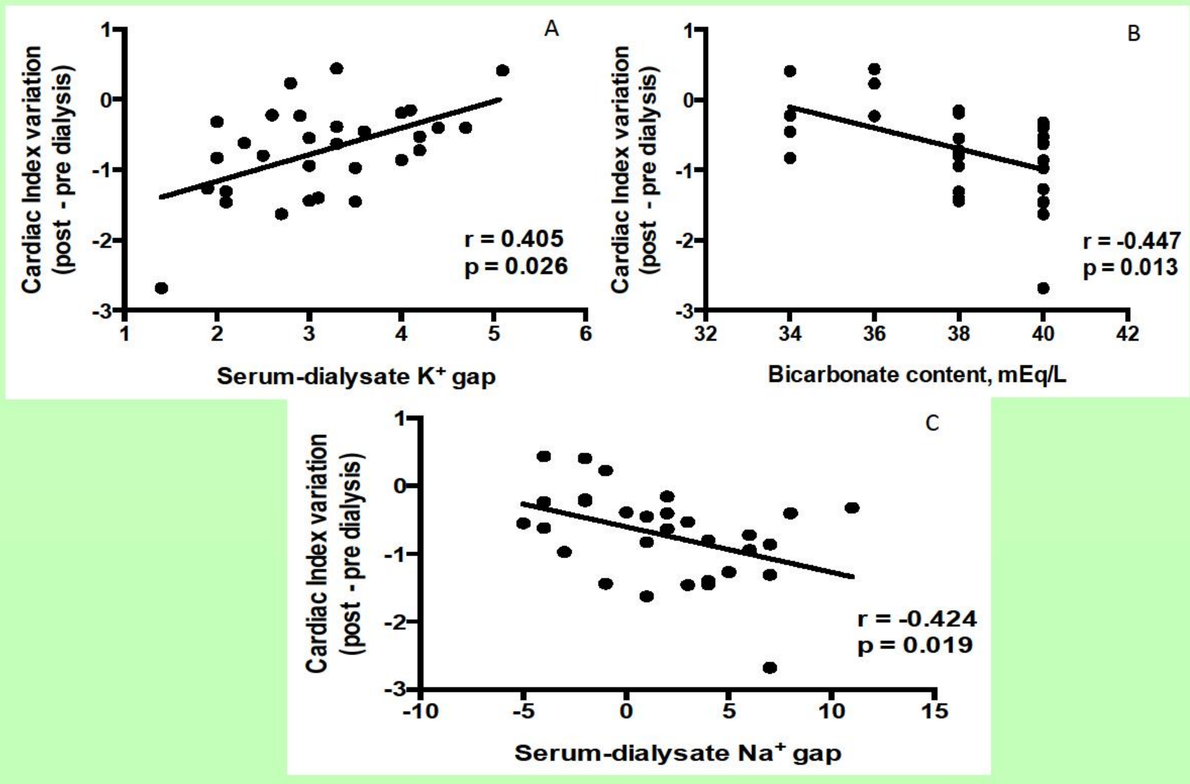
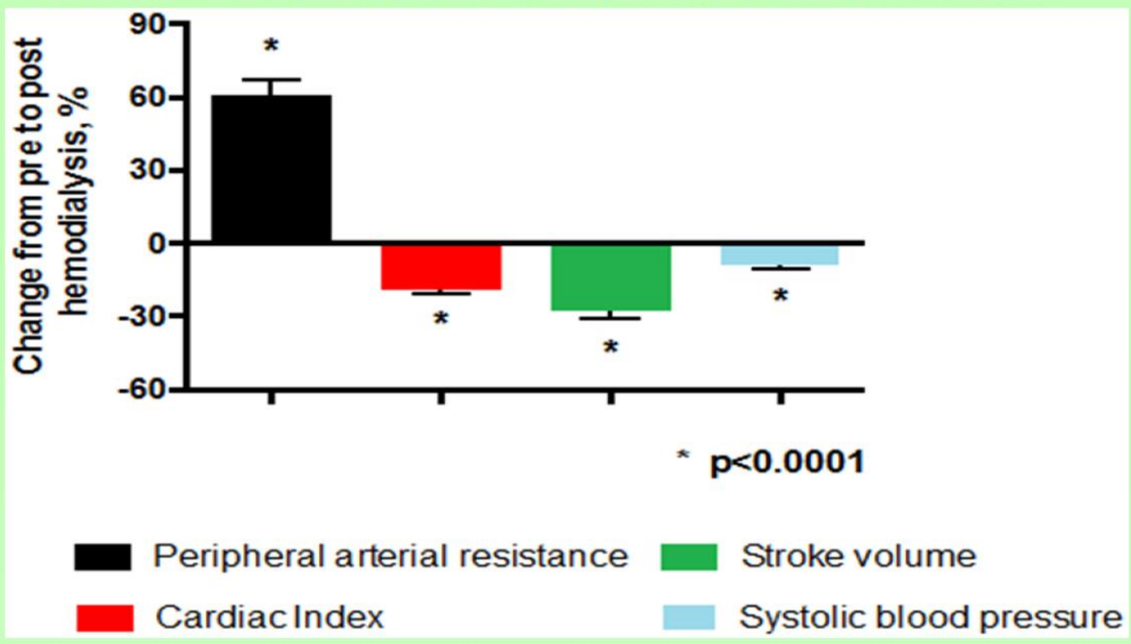


Figure 2. Changes in hemodynamic from pre to post HD, expressed as % of chance ±



- Mean ultrafiltration rate was 11.2 ± 4.4 L/Kg/h, and serum bicarbonate variation was 8.9 ± 3.7 mEq/L.
- Median serum-dialysate gap of Na^+(Na^+ gap) was +2.0 (-2.0, 5.2) mEq/L.
- Physiological response to ultrafiltration (post dialysis CI drop and peripheral arterial resistance raise) was observed: cardiac index (CI) variation (post *minus* pre dialysis value) was -0.625 L/min/m² (-1.280, 0.297) and peripheral arterial resistance variation was 229.0 (19.5, 408.0) dyn.s/cm⁵.
- The drop in CI was correlated to the serum-dialysate K^+ gap (K^+ gap), as well as to the bicarbonate content, and the Na^+ gap (Figure 1). In multiple regression analysis either the higher K^+ gap or the higher the bicarbonate dialysate content, the worse post HD CI drop was observed (p=0.002 and 0.004, respectively, with adjusted r^2=0.426). In addition, further multiple regression model shows that either the lower Na^+ gap or the higher K^+ gap, the worse the drop in CI (p=0.022 and 0.004, respectively, with adjusted r^2=0.357).

CONCLUSIONS

Dialysate prescription influences hemodynamic behavior during HD procedure.

It seems that increasingly positive bicarbonate balance may exacerbate the expected CI drop after HD procedure, independent of K^+ gap. The same was observed with lower Na^+ gap.

Further investigations to reveal the optimal composition of dialysate bicarbonate and sodium content, and the effect of K^+ on hemodynamic changes during HD are needed.

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