Intradialytic connection between blood pressure and hydration status in HD patients

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AIMS
• to investigate whether the prevailing hydration status (HS) and systolic blood pressure (BP) before dialysis could predict how an individual patient is likely to react to fluid removal.

METHODS
• BP was measured before and after dialysis treatment in 566 patients.
• Pre-dialysis hydration status (HSpre) was measured before the treatment using the BCM-Body Composition Monitor (Fresenius Medical Care), see Figure 1.
• Post-dialysis hydration status was calculated by subtracting the ultrafiltration volume (UFV) from pre-dialysis hydration status.
• Each measurement was entered into a diagram (hydration reference plot, HRP), see Figure 4. The region N characterises the reference range of a healthy population, Dx indicates a range of well controlled dialysis patients, and I to IV resemble different relationships between BP and hydration status.
• Each short line in the diagram represents a single treatment indicating the pre to post change in BP and hydration status.
• The data was filtered using a 2D lowpass filter to reveal the underlying morphology (streamlines to a g).

RESULTS
• Patients in group II (high BP, normal or low hydration status) exhibit the strongest average decrease in blood pressure over the treatment (streamline a).
• Patients in group IV with low BP and high hydration status on the contrary may even present increases in blood pressure during treatment (streamline g).
• Group N, Dx and I patients show mild or stronger changes in BP and hydration status, depending on the prevailing location of BP and pre-dialysis hydration status.

CONCLUSION
• In patients with reduced hydration status, intradialytic fluid removal leads to larger drops in BP, increasing the likelihood of hypotensive events.
• Despite the low prevailing BP presented in some patients, intradialytic fluid removal does not always cause a drop in BP. In some patients within this category an improvement in cardiac output might be implicated.
• This study further underlines the necessity of measuring both BP and hydration status.

Please visit the following related posters:
Thursday:
• TH-P0606 “Following the Target of Normohydration provided by BIS reduces Fluid Overload and IMEs.”
• TH-P0615 “Fluid Overload in European Dialysis Centers.”
Friday:
• F-P1682 “Malnutrition and Fluid Overload in HD patients – prevalence and risk.”

Whole body BIS - measurement

Calculation

Fluid model


Body composition model


Table 1: Comparison of BIS-results versus Ultrafiltration volume (UFV)

<table>
<thead>
<tr>
<th></th>
<th>Immediately after treatment</th>
<th>30 min after treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>UFV (kg)</td>
<td>2.50 ± 0.79</td>
<td>2.50 ± 0.79</td>
</tr>
<tr>
<td>Δ ECW [L]</td>
<td>2.48 ± 1.0°</td>
<td>2.45 ± 1.12°</td>
</tr>
<tr>
<td>Δ TBW [L]</td>
<td>1.92 ± 1.63</td>
<td>2.54 ± 1.4°</td>
</tr>
<tr>
<td>Δ Hydr. Status [L]</td>
<td>2.78 ± 1.1°</td>
<td>2.44 ± 1.09°</td>
</tr>
<tr>
<td>Δ ICW [L]</td>
<td>-1.34 ± 1.54°</td>
<td>-0.99 ± 0.57°</td>
</tr>
<tr>
<td>Δ Fat mass [kg]</td>
<td>0.90 ± 1.37°</td>
<td>-0.39 ± 0.9°</td>
</tr>
<tr>
<td>Δ Lean mass [kg]</td>
<td>-1.12 ± 1.17°</td>
<td>-0.39 ± 0.95°</td>
</tr>
</tbody>
</table>

* = n.s.d. from UFV, ** = s.d. from Zero, ° = n.s.d. from Zero

Figure 1: Procedure of measurement and calculation of the BCM. From the measurement via the fluid model to the body composition model distinguishing overhydration from lean tissue and adipose mass.

Figure 2: BIS was measured at different times before and after dialysis. Results show that a valid BIS measurement requires at least 30 minutes of equilibration time after the treatment (see Table 1).

Figure 3: Explanation of the red lines in Figure 4: The starting point (upper right) indicates a measurement of hydration status and BPs before dialysis. The line (scaled down by a factor of 8) represents the direction of the end point (not the end point itself for readability). Post-dialysis hydration status was determined by subtracting UFV from pre-dialysis hydration status.

Figure 4: Streamlines in the BP/HS-Plot: Patients react differently to fluid removal, depending on their initial hydration status and pre-dialysis systolic blood pressure. Each short line in the diagram represents a single treatment indicating the pre to post change in BP and hydration status.

Take-home message:
• Low or normal BP is not always a sign of optimal hydration status.
• The amount of BP change is dependent on the combination of pre-dialysis hydration status and BP