THE USE OF AN INTERACTIVE WATER BOTTLE TO MAINTAIN HYDRATION ADHERENCE IN PEDIATRIC RENAL TRANSPLANT RECIPIENTS

By Penny Scholl, RN, BSN, CCTC

I am not sure how the rest of the world of renal transplant is able to get their patients to maintain hydration, but we at St. Louis Children’s Hospital (SLCH) and Washington University (Wash U) struggle with this issue frequently. I and the other renal transplant coordinators at SLCH are calling patients weekly with the old familiar “drink and repeat” phrase. This means to drink more water than you have been and repeat labs in a week.

I and my two mentors, Paul Hmiel, PhD and Kristen Kullgren PhD., searched for any prior research studying adherence to fluid intake recommendations following pediatric renal transplant. We found none. However, there are studies in other populations where fluid intake is important that suggest that sticking to hydration recommendations is challenging. Kuhl, Felt, & Patton (2009) reported that less than half of children with retentive encopresis met their fluid goals. In the adult renal transplant population, Gordan, Prohaska, Gallant, & Siminoff (2009) found that only about one third of adult renal transplant recipients were adherent to required fluid volumes. Barriers to staying hydrated included not feeling thirsty, not remembering to drink fluids and not having the preferred fluids available.

We proposed a study to see if use of an interactive water bottle (HydraCoach®) would improve adherence to water intake in the post transplant pediatric population relative to our standard of care for increasing fluid intake. The HydraCoach® displays the average amount of water consumed per hour, monitors the total amount of fluid consumed throughout the day, displays percentage of fluid consumed relative to personal goal and displays amount of time elapsed for the day to reinforce proper pacing.

Our current standard of care is to educate the post renal transplant patients to drink a lot of water. We currently do not have a way to measure exactly how much they are consuming, other than recall histories during clinic appointments. We also wanted to know if the use of an interactive water bottle would impact laboratory values and would patients report satisfaction with the use of the bottle?

We enrolled 32 post renal transplant patients from our renal transplant clinic at SLCH. Inclusion criteria included greater than 5 years old and greater than 1 month post transplant. Exclusion criteria included non English speaking and children whose cognitive functioning would interfere with ability to participate.

This was a randomized controlled study and we enrolled in either the control or intervention group based on clinic week. Participants were block randomized by clinic week into treatment or control group. Clinical laboratory results were compared at baseline (Time 1) and at study end one month later (Time 2).

We reviewed serum sodium, blood urea nitrogen, creatinine, and urine specific gravity as available. This information is gathered as part of standard of care from both groups. We also asked participants to record a fluid intake diary for 30 days. The control group received the HydraCoach® at study completion and the intervention group was asked to complete a survey. All participants were provided with a daily fluid goal. The changes in participant’s laboratory
data over time was analyzed using paired sample t-tests. Group characteristics at Time 1
analyzed using one-way ANOVA to determine if groups vary by any characteristics despite
randomization. Group (intervention vs. control) outcomes at Time 2 analyzed using analysis of
variance. Data analyzed using SPSS v16.0 computer program. Frequencies were run for all
variables to determine if there are any missing data or outliers.

Our results were not as we predicted. There was no change in the serum sodium or the blood
urea nitrogen (BUN). There was no hyponatremia with fluid intake greater than goal. There was
a statistically significant increase in Creatinine (p< .05) from Time 1 to Time 2. There were no
significant differences between the groups. Older age and longer time since transplant was
associated with higher Time 2 creatinine. (Table 1)

Sixty nine percent of the control group and fifty eight percent of the intervention group tracked
fluid intake and returned a fluid intake diary. 42 percent of all participants fell below fluid
target. The range of fluid goal was from 39% below goal to 98% above goal.

Participants in the intervention group largely reported satisfaction with the water bottle and
were likely to continue its use. The majority of patients found it easy to use, used it nearly every
day and would continue its use. Fifty eight percent reported they thought the HydraCoach®
helped increase daily water intake.

The data suggests that the use of the water bottle may be an intervention to help meet fluid
goals although tracking itself may have been an intervention. Even though the intervention
group had better fluid intake it did not appear to positively impact the BUN and creatinine.

Limitations of the water bottle study include relying on self-report data from the participants
regarding their fluid intake, potential for inaccurate reporting and water bottle failure.

We anticipate that the results of this study will improve our clinical practice in our renal
transplant clinics. We hope that the results will provide us with new strategies that are relevant
to youth following renal transplant that will improve their outcomes

These results may be applicable to other illnesses of childhood where increased fluid intake is
necessary including kidney stones, urologic disorders and, enuresis.

These results may also be applicable to other illnesses of childhood where limiting fluid intake is
necessary such as patients on dialysis, patients with nephrotic syndrome, and some endocrine
disorders.

Data collection during the hot summer months may have impacted outcomes. Future research
should track outcomes over a longer time period.
References:


Table 1: Fluid outcomes and laboratory value outcomes mean (SD)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Control (n = 16)</th>
<th>Intervention (n = 16)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tracked fluid intake</td>
<td>68.8% (n = 11)</td>
<td>56.3% (n = 9)</td>
<td>0.48</td>
</tr>
<tr>
<td>Fluid goal (ounces)</td>
<td>77.0 (11.4)</td>
<td>76.7 (22.2)</td>
<td>0.96</td>
</tr>
<tr>
<td>Fluid achieved (ounces)</td>
<td>69.4 (27.0)</td>
<td>91.0 (33.4)</td>
<td>0.14</td>
</tr>
<tr>
<td>Sodium Time 1</td>
<td>139.9 (2.4)</td>
<td>140.1 (1.8)</td>
<td>0.80</td>
</tr>
<tr>
<td>Sodium Time 2</td>
<td>138.8 (2.1)</td>
<td>139.6 (2.1)</td>
<td>0.28</td>
</tr>
<tr>
<td>BUN Time 1</td>
<td>20.6 (6.4)</td>
<td>18.9 (5.8)</td>
<td>0.55</td>
</tr>
<tr>
<td>BUN Time 2</td>
<td>21.6 (7.2)</td>
<td>19.1 (5.8)</td>
<td>0.29</td>
</tr>
<tr>
<td>Creatinine Time 1</td>
<td>1.21 (0.34)</td>
<td>0.99 (0.30)</td>
<td>0.07</td>
</tr>
<tr>
<td>Creatinine Time 2</td>
<td>1.27 (0.38)</td>
<td>1.09 (0.32)</td>
<td>0.15</td>
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</tbody>
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