Examining the Effects of Dietary Modifications on Nephrolithiasis Risk in Medically Complex Children

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Introduction: Medically complex children are particularly vulnerable to forming kidney stones (nephrolithiasis). We previously showed that there are elevated oxalate levels in patients on enteral feeding formulas primarily based on soy protein, a known high oxalate food. Hyperoxaluria may predispose patients to calcium oxalate stones. The purpose is to examine metabolic risk factors in medically complex children to assess if targeted dietary intervention decreases oxalate excretion.

Methods: A retrospective cohort study was performed on medically complex children with cerebral palsy, severe developmental delays, gastrostomy feeds, and/or non-ambulatory status presenting to a high-volume Pediatric Stone Center from 2015 to 2020. Patients underwent thorough dietary and urinary metabolic evaluations before and after an index visit. Patient diets were documented by a registered dietician, and urine metabolites were analyzed via a 24-hour urine collection sent to Litholink Corporation. Dietary oxalate load was determined by evaluating individual recipes for known high oxalate ingredients (e.g., sweet-potatoes, spinach, almonds) or soy-based formulas (e.g., Jevity 1.0 and Boost 1.0). Comparisons were analyzed using paired sample t-tests.

Results: A total of 27 medically complex children enrolled in the Stone Center were identified. 13 patients (7 females, 6 males) met the inclusion criteria for completing a Litholink study both before and after their index visit (median of 6.5 months between Litholink studies). 85% (11/13) of participants were gastrostomy-fed. We compared urine metabolites in patients who were treated with a low oxalate diet ($N = 4$) to those who maintained their initial diets ($N = 9$). In patients on high oxalate diets, there was a significant increase in urine oxalate excretion (71 vs. 26 mg/m^2/day, $P = 0.001$) and supersaturation of calcium oxalate (14.3 vs. 6.1, $P = 0.011$). More importantly, of those who changed from high to low oxalate diets ($N = 4$), we found a significant decrease in urine oxalate excretion (67 vs. 31 mg/m^2/day, $P = 0.05$). Urine excretion of calcium and citrate as well as the supersaturation of calcium oxalate and calcium phosphate were similar following dietary modifications.

Conclusions: Urine oxalate excretion and supersaturation of calcium oxalate were dependent on dietary oxalate content in medically complex children. Targeted dietary intervention to reduce the oxalate load in oral and enteral formulas can lead to a substantial decrease in urine oxalate excretion. Further investigation is required to determine if this leads to lower stone recurrence, hospitalizations, and the need for surgical interventions.

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