

Use of BNP as Quantitative Marker of Fluid Overload in Neonatal RRT



Noureddin Nourbakhsh^{1,2}, Nadine Benador^{1,2}

1. Rady Children’s Hospital, San Diego

2. University of California, San Diego Medical Center



OBJECTIVES

Neonatal renal replacement therapy (RRT) remains one of the most challenging dialysis scenarios in Pediatric Nephrology. Evaluation of dry weight can be particularly difficult as fluid overload may be mistaken for adequate nutritional weight gain. Physical exam is insensitive in assessing hypervolemia until the patient has developed significant fluid overload. Non-invasive BP measurements are often hard to obtain as upper extremities are often used for intravenous access and patient cooperation/degree of sedation alters measurement. B-type natriuretic peptide (BNP) has long been used in the evaluation of heart failure and has even been reported to be a marker of fluid overload in adult hemodialysis patients, but it’s role has been questioned due to co-morbidities of cardiac disease and heart failure in adults. The purpose of our study was to evaluate the role of BNP as a quantitative marker of fluid overload in a neonate with end-stage renal disease.

METHODS

Case study of a 3 week old, ex-37 week baby girl with bilateral renal agenesis requiring emergent RRT. While transitioning between various forms of RRT, B-type natriuretic peptide (BNP) via chemiluminescent microparticle immunoassay (CMIA) was utilized as a quantitative marker of fluid. Over 31 days of observation, BNP, weight, blood pressure and intake/output were assessed and compared as means of determining patient’s ultrafiltration needs.

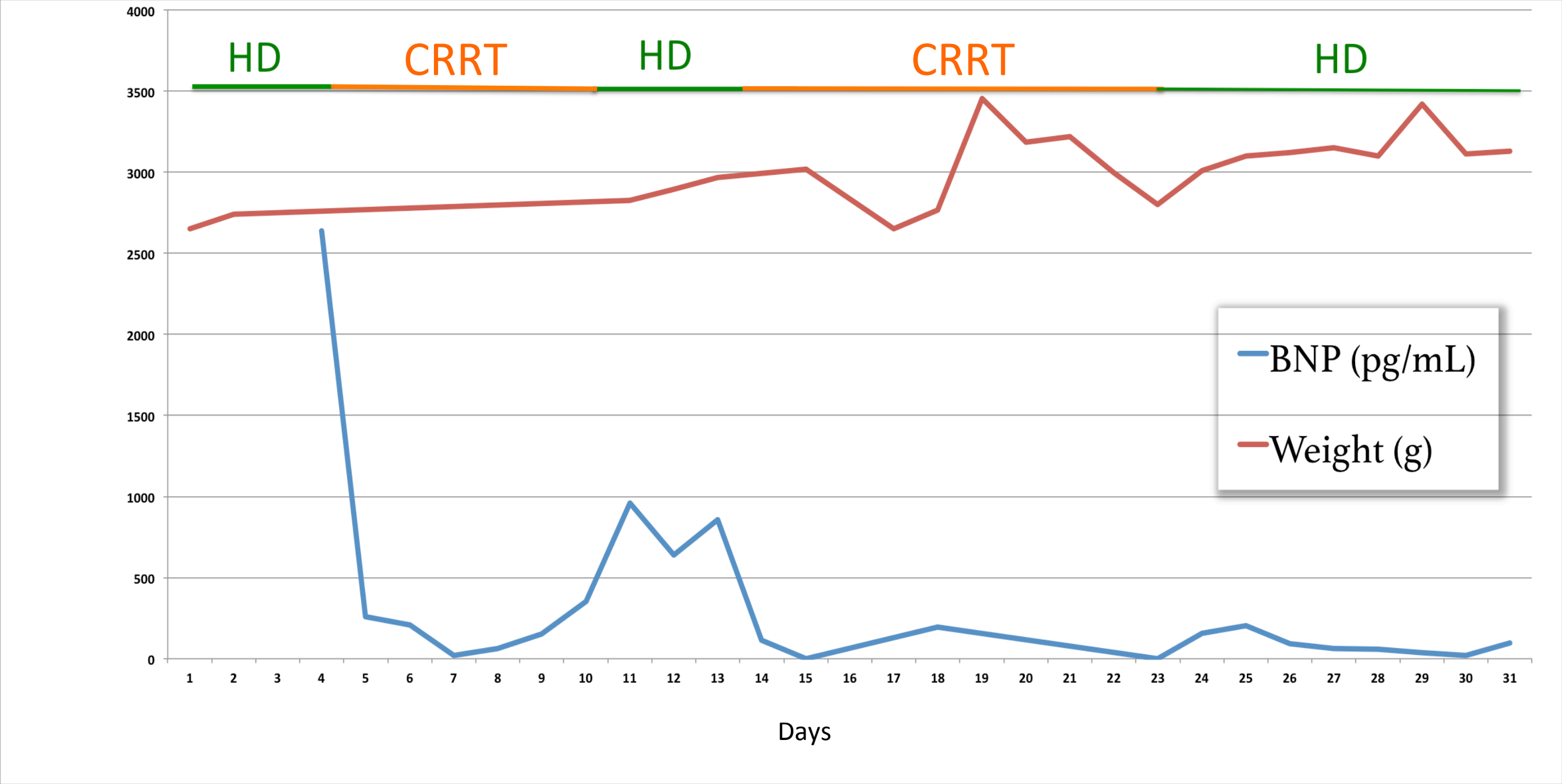


Figure 1. BNP, Weight and RRT modality. Linear plot of values comparing BNP and weight with respect to RRT modality used. As patient’s weight increases through the course of hospitalization, BNP exhibits daily variation.

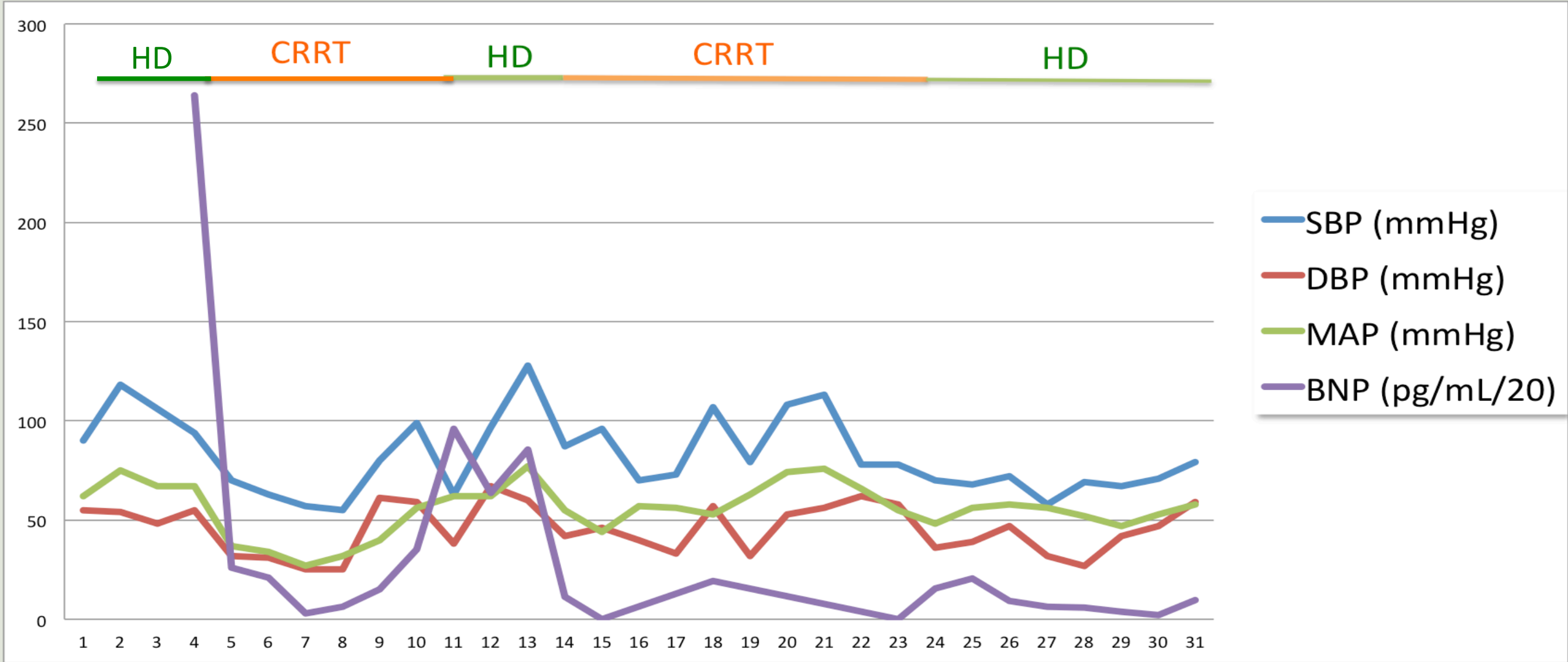


Figure 2. BNP, SBP, DBP, MAP and RRT modality. Linear plot of values comparing BNP and weight with respect to RRT modality used.

RESULTS

Patient was born at 37 weeks gestation with bilateral renal agenesis, requiring emergent RRT. Following the failure of peritoneal dialysis due to peritoneal leak in this 2.19 kg child, RRT modality was converted to hemodialysis. Despite daily 3 hr hemodialysis (HD) treatments with ultrafiltration (UF) goals guided by weight, physical exam findings and blood pressure, patient developed bilateral pulmonary edema and an enlarged cardiac silhouette at 3 weeks of age. BNP was found to be > 5,000 pg/mL and RRT modality was changed to continuous veno-venous hemodiafiltration (CVVHDF). BNP normalized after 4 days of CVVHDF, but upon transition to HD and without use of BNP, she again developed fluid overload and required placement back on CVVHDF . Thereafter, BNP was utilized as a quantitative marker of fluid overload with ultrafiltration goal guided by pre- and post-dialysis BNP levels. Utilizing this technique, she had no further episodes of fluid overload.

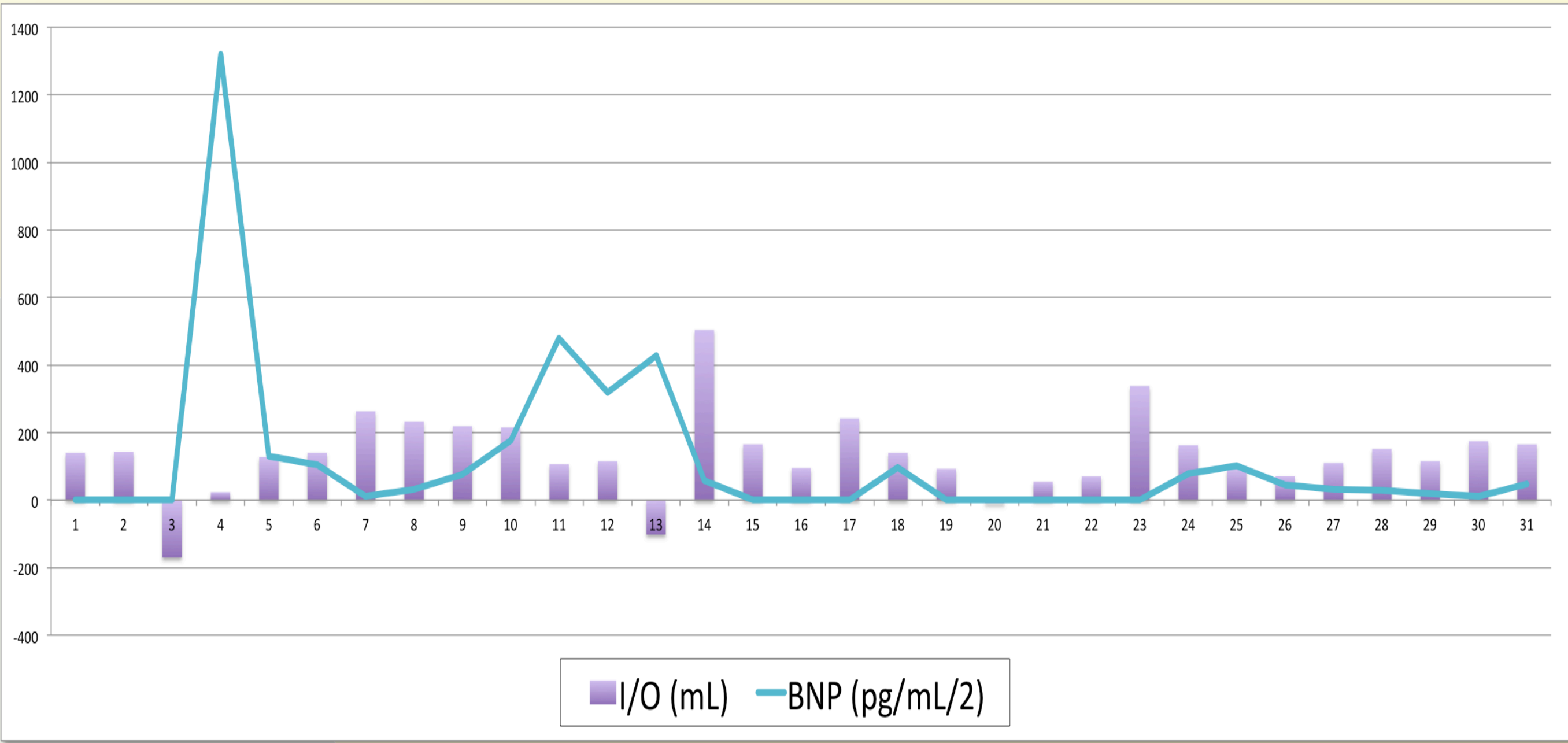


Figure 3. BNP and In’s/Out’s. Linear plot of values comparing BNP and In’s/Out’s. Notable findings: Day 3-4: patient has a negative fluid balance but significantly elevated BNP. Day 14: patient has a large positive fluid balance but declining BNP value.

CONCLUSIONS

Providing successful dialysis in small children is more problematic than in older patients. Recognized technical challenges are establishment of access and maintaining adequate fluid status as their nutrition is provided only in liquid form. To assess fluid overload in children on dialysis, traditional tools include clinical assessment by the provider (which can be subjective), serial weights (may be difficult to obtain in critically ill neonatal intensive care patients on respiratory support) and measuring blood pressure (often technically challenging due to motion and crying). Finally, transition of care between providers can confound assessment of fluid balance.

In this low birth weight infant with no preexisting comorbidity, measurement of serial BNP levels proved to be an effective, quantitative assessment of volume status, which was helpful in maintaining dry weight and lead to successful dialysis therapy. A formal study on BNP in infants to confirm these findings is currently being investigated.