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Quality Improvement Initiative Assessing Real-Time Hematocrit Monitoring to Predict Dosage Adjustment of Erythropoietin Stimulating Agents in Pediatric Chronic Hemodialysis Patients

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Background: In many hospital-based pediatric dialysis units, patients receiving hemodialysis are monitored with hematocrit-based blood volume monitoring devices (CritLine Monitor (CLM)) for fluid management. This is a non-invasive monitor that uses photo-optical technology to measure percent blood volume change, continuous oxygen saturation and absolute hemoglobin (Hgb) and hematocrit (Hct) in real-time. These real-time Hgb/Hct values are not currently used for determining Erythrocyte Stimulating Agents (ESA) dosages.

Objective: This process improvement project sought to determine the utility of using CLM Hgb/Hct as a basis for therapeutic interventions with ESA dosing. We knew that the CritLine Monitor (CLM) measures a true in vivo Hgb/Hct value by transillumination of whole human blood in an extracorporeal circuit defined by the formula ($Hct = RBC \text{ volume} / RBC \text{ volume} + \text{Plasma volume}$ / where RBC = Red Blood Cell). We then compared the accuracy of patients' pre-dialysis serum Hct with their CLM values.

Results: The results were clinically significant when data was collected on one clinically stable pediatric dialysis patient. On the days when both CLM and blood draw hematocrit were obtained, the results were nearly identical. The mean difference for the values was 1.28 and the standard deviation was 1.23.

Conclusions: This study demonstrates CLM hematocrit values correlated with blood draw values and subsequent ESA dosing changes in one stable pediatric dialysis patient. (Did we really dose the ESA dosages in accordance with the hct line values or is this an implication of the study?) In one patient, dosage changes were predicted 19 days before the corresponding blood draw that lead to the actual therapy change. Historically, monthly blood draws are used to adjust ESA dosages for target ranges of hemoglobin and hematocrit. However, these values can change relatively quickly or there may be technical reasons for erroneous laboratory measurements that make repeated real-time measures a more reliable and rapid way to make dosage adjustments.

Implications for Nephrology Nurses: Real-time measurements may provide a more pro-active, cost effective way to make safe dose adjustments to erythrocyte stimulating agents. However, large scale studies in different ESRD populations are necessary to validate this non-invasive method of monitoring hemoglobin and hematocrit and thus determining appropriate ESA dosing to achieve the narrow, recommended target.

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