

Abstract

Purpose: A reticulocyte hemoglobin equivalent (RET-He) is a new CBC parameter available from modern CBC analyzers. The RET-He provides a direct estimate of the recent functional availability of iron into erythrocyte hemoglobin and has clinical utility in evaluating changes in iron status in renal dialysis patients. The clinical utility of RET-He in the diagnosis and management of preoperative (preop) iron deficiency has not been studied. The purpose of this study is to observe the relationship between the results of standard serum iron studies, hemoglobin (Hgb) levels and the RET-He in patients receiving preoperative intravenous (IV) iron therapy.

Methods: A retrospective chart review was conducted on fifty consecutive preoperative patients treated for iron deficiency. The results of serum iron indices, Hgb, and RET-He were observed pre and post iron therapy.

Results: Inspection of the raw data was done using scatter and slope plots. Scatter plots suggested a possible relationship between Hgb and RET-He. Slope plots for Hgb and RET-He were not informative due to the wide variation in timing of the pre and post blood work relative to the date of the IV iron therapy. The raw data was standardized as percent change and rate of change for the Hgb and RET-He after the 1st IV iron infusion. The only time interval measured was between the 1st IV iron infusion and the 1st IV iron infusion blood work. The greatest percent and rate of increase in RET-He was observed in the samples obtained soonest (3 days) after the IV infusion and declined steadily thereafter, and with the most rapid increase seen with lower pre-infusion RET-He levels. The Hgb level did not show a positive percent and rate of increase until approximately seven days after the IV iron infusion. A multiple linear regression model for percent change and rate of change for Hgb and RET-He suggest that low pre-infusion concentrations of RET-He result in a greater rate of change in RET-He post iron infusion compared to rate of change of hemoglobin.

Conclusions: RET-He appears to be an early marker of iron sufficiency. Based on these findings prospective studies are needed to further investigate pre RET-He as a predictor for the rate of hemoglobin increment post IV iron therapy.

Background

- Rapid and effective diagnosis and treatment of iron deficiency anemia is a key component of The Ottawa Hospital Pre-operative Blood Conservation Program
- Preoperative anemia increases surgical risk, perioperative blood transfusions and can delay surgery date
- Conventional indirect iron tests are acute phase reactants and can provide unreliable results in the presence of inflammatory and malignant diseases
- RET-He measures the amount of Hgb in reticulocytes and provides a direct cellular estimate of how much iron is available to the marrow for erythropoiesis
- RET-He is measured during a routine reticulocyte analysis using an automated hematology analyzer. Normal reference range 29-39 pg
- Measuring RET-He is considered a sensitive test to assess iron status but its utility has not been shown in preoperative iron therapy

Methods & Results

Figure 1
Scatterplot for RET-He & Hgb

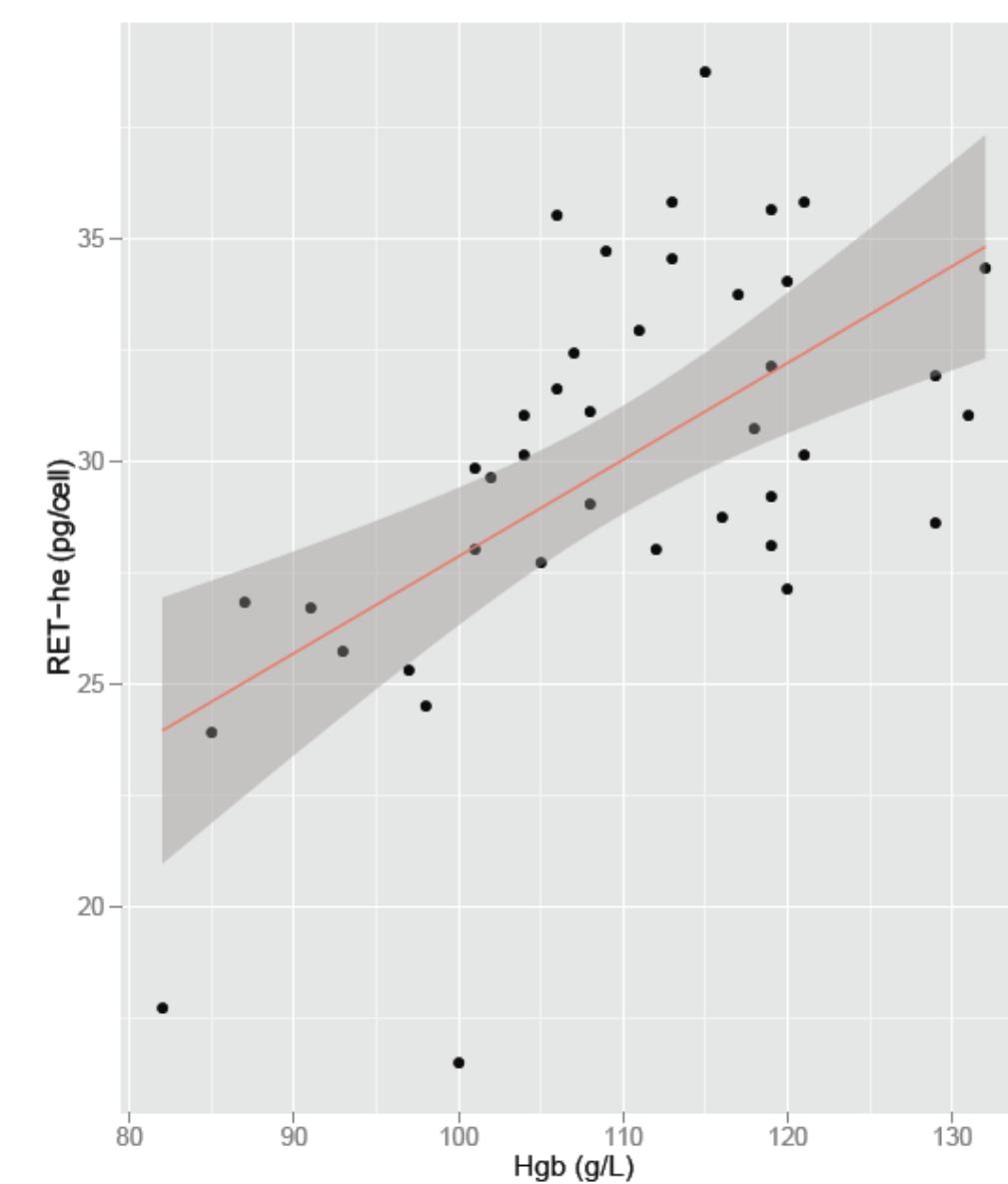
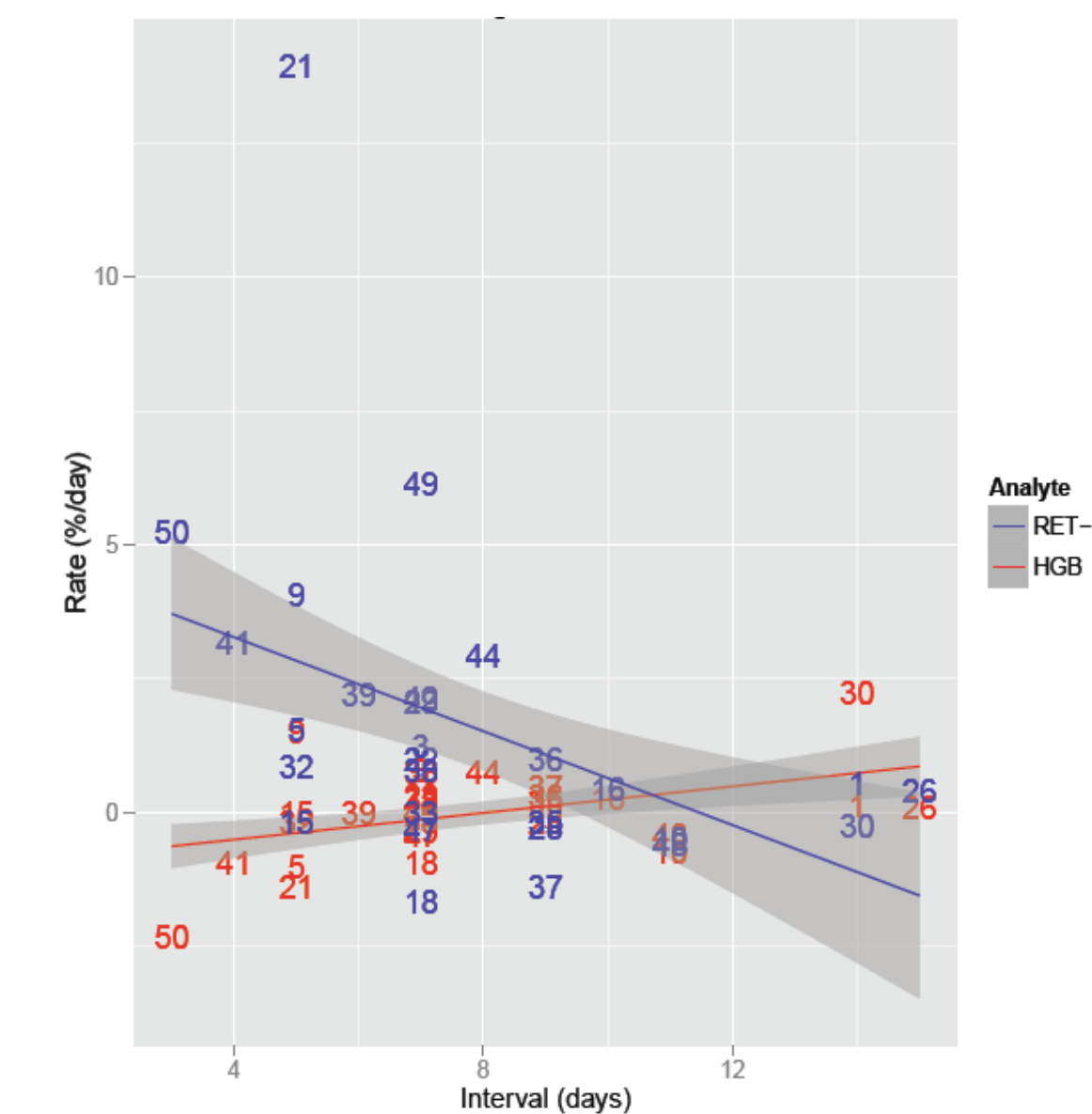


Figure 2
Rate of Change RET-He & Hgb



- A retrospective case review was conducted to observe the relationship between the results of standardized diagnostic iron tests, hemoglobin, and RET-He pre and post IV iron sucrose infusions
- The study included fifty pre-op patients who received intravenous iron sucrose
- The scatterplot (figure 1) suggested a relationship between RET-He and Hgb
- A lack of standardization with the data made the analysis challenging to interpret, particularly the variability in the timing of the blood work after the IV iron infusions
- Only the first iron infusion blood work from 28 patients were included in the analysis
- The raw data was standardized to percent change and rate of change in order to facilitate a direct comparison between the change in Hgb and RET-He post iron infusion
- A paired T test showed a statistical difference for percent change for Hgb and RET-He ($t = -3.04$, $df = 55$, $p = 0.0036$, CI 95%) post infusion
- A paired T test showed a stronger statistical difference for rate of change for Hgb and RET-He ($t = -3.52$, $df = 55$, $p = 0.00086$, CI 95%) post infusion
- A multiple regression analysis was done to examine the relationships between rate of change of Hgb, RET-He, and other potential predictors
- Figure 2 shows an inverse relationship between rate of change of Hgb and RET-He
- The rate of change of RET-He is faster than the rate of change of Hgb post IV iron infusion
- A lower pre RET-He will result in a more rapid change in RET-He post infusion
- A pre infusion RET-He concentration can predict rate of RET-He post infusion
- The time interval is a predictor of the rate of change of Hgb post iron infusion
- The analysis suggests pre RET-He is predictive of the rate of change for Hgb post iron infusion

Discussion

- The typical treatment period between identifying pre-op iron deficiency anemia and date of surgery is usually two weeks to one month
- Identifying early iron sufficiency post iron therapy is essential when treatment time prior to surgery is short
- RET-He is reliable and unaffected by inflammation and other disease states
- RET-He can provide valuable information about the patient's iron status in the early periods post first IV iron infusion when other tests are not informative
- Hgb is slower to rise post IV iron infusion compared to RET-He
- RET-He may help streamline the total iron dosage needed for adequate erythropoiesis
- There were limitations to our study associated with the retrospective methodology and lack of standardized data, particularly the variability in the timing of the blood work post IV iron infusions
- These findings suggest that future controlled studies are needed to further investigate the predictive value of pre RET-He for hemoglobin rate of change post IV iron

Conclusions

- RET-He is a new parameter easily performed during routine blood testing
- RET-He is an earlier marker of iron sufficiency post first IV iron infusion
- Hgb rate of change is slower and occurs over a longer interval of time post IV iron compared to RET-He
- Pre RET-He is predictive of hemoglobin rate of change post infusion
- With further study, RET-He may prove to be useful to guide total preoperative iron dosage
- Prospective controlled studies are needed to further investigate whether RET-He concentrations can predict Hgb level on the date of surgery (post IV iron)

References

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