

The relationship between vacuum and hemolysis during catheter blood collection: a retrospective analysis of six large cohorts

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Abstract

Background: Blood collection through intravenous (IV) catheters is a common practice at emergency departments (EDs). This technique is associated with higher *in vitro* hemolysis rates and may even be amplified by the use of vacuum collection tubes. Our aim was to investigate the association of five different vacuum tubes with hemolysis rates in comparison to an aspiration system under real-life conditions and to propose an equation to estimate the amount of hemolysis, depending on the vacuum collection tube type.

Methods: We retrospectively evaluated hemolysis data of plasma samples from our ED, where blood is drawn through IV catheters. Over the past 5 years, we compared 19,001 hemolysis index values amongst each other and against the respective vacuum pressure (Pv) of the collection tubes, which were used within the six observational periods.

Results: The highest hemolysis rates were associated with full-draw evacuated tubes. Significantly reduced hemolysis was observed for two kinds of partial-draw tubes. The hemolysis rate of one partial-draw blood collection tube was comparable to those of the aspiration system. Regression analysis of Pv and mean free hemoglobin (fHb) values yielded the formula $fHb (g/L) = 0.0082 * Pv^2 - 0.1143 * Pv + 0.5314$ with an R2 of 0.99.

Conclusions: If IV catheters are used for blood collection, hemolysis rates directly correlate with the vacuum within the tubes and can be estimated by the proposed formula. By the use of partial-draw vacuum blood collection tubes, hemolysis rates in IV catheter collections can be reduced to levels comparable with collections performed by aspiration systems.

Keywords: blood collection; emergency department; hemolysis; preanalytics.