Changes in Hematocrit Based On Incremental Blood Sampling in Healthy Human Volunteers

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Introduction: Excessive phlebotomy is a growing concern among clinicians caring for patients requiring frequent blood sampling for laboratory analysis. This is of particular concern among physicians caring for patients in intensive care units, where blood sampling can sometimes occur on an hourly basis.[1,2] In addition, there is considerable data on acute blood loss in healthy volunteers.[3,4,5] However, there is a paucity of data on the effect of incremental phlebotomy on healthy subjects. In this study we looked at the change in hematocrit values in five healthy volunteers who had undergone a 24-hour laboratory investigation requiring multiple pharmacokinetic and arterial blood gas samples.

Methods: After obtaining informed consent and IRB approval, five healthy volunteers age 20-24 with no significant past medical history, participated in a laboratory investigation assessing the analgesic and respiratory sparing properties of dexmedetomidine. As per the study protocol, subjects were kept NPO after midnight. An 18g IV was started in their left arm, and a crystalloid infusion was given at a rate of 100cc/hr until completion of the study. Twenty-five (25) pharmacokinetic and 67 arterial blood gas samples were obtained over 24 hours. Approximately 300cc of blood was collected from each subject during this time period. Blood gas sampling was done by a VIAV-ABG1 (VIA Medical Corporation) in line arterial blood gas analyzer. Statistical analysis was completed using Microsoft Excel software. Simple linear regression was done, and data were displayed on a scatterplot looking at the change in hematocrit as a function of time. A coefficient of multiple determination R^2 was calculated. Screening Het and finishing Het were compared using a paired Student t test.

Results: Three subjects out of five had moderate to good correlation (R^2 of 0.63, 0.68 and 0.66, respectively). Two subjects had no correlation (R^2 of 0.09 and 0.15, respectively). The average starting Het among five subjects was 44.2, and the average finishing Het was 40.4. The paired Student t test revealed a $p=0.02$.

Discussion: This study demonstrates the same kind of change in Het one would see during an acute blood loss, despite the fact that we withdrew 300cc of blood incrementally over a 24-hour period. Based on our model, we expected our finishing HET to be 41.5, so these results are consistent with our model. Our subjects remained hemodynamically stable throughout the study. Our subjects arrived fasted, and hence arrived with a fluid deficit. Their starting Het may have represented hemoconcentration. These data support that this level of phlebotomy is safe. This hematocrit change was statistically significant, but not clinically significant. Furthermore, there doesn't appear to be any compensatory erythropoietic mechanisms that obtain within this 24-hour period.

References:

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