Sample Volume: What's Appropriate?

Second only to hemolysis, insufficient sample quantity – not enough blood drawn to perform the required tests – is a common reason for specimen rejection and redraw.

But there's more to just collecting a sufficient sample. It's about drawing the appropriate volume of blood – the minimum amount required for a specific range of tests – as well as the amount for which the tube was designed.

Blood collection tubes contain specific types and quantities of additives and are designed for the collection of a predetermined quantity of blood in order to achieve a defined concentration of additive in the blood sample (e.g., a correct blood to additive ratio). An incorrect blood to additive ratio can lead to inaccurate test results and inappropriate patient management.

If the final concentration of the additive is too high (e.g., from underfilling of the tube), preanalytical errors such as hemolysis, changes in cell morphology, and prolonged coagulation times may occur. If the final concentration is too low (e.g., from overfilling), delayed clotting or fibrin formation (serum), inadequate coagulation or the formation of microclots (plasma or whole blood), which, in turn, can affect instrument performance.

Following guidelines, such as those from CLSI, can define proper sample volume. Further, collection of more blood than required to perform testing can lead to anemia in hospitalized patients, especially infants and intensive care patients, and result in wasting of blood.

Advances in instrument technology and the use of smaller collection tubes can decrease collection volumes, without compromising reliable and timely test results.

Resources:

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- Pseudopolycythemia, pseudothrombocytopenia, and pseudoleukopenia due to overfilling of blood collection vacuum tubes. Pewarchuk W, Vanderboom J, Blajchman MA. Arch Pathol Lab Med 1992;116:90-92.
- CLSI document H1-A5. Tubes and Additives for Venous Blood Specimen Collection; Approved Standard – Fifth Edition. (ISBN 1-56238-519-4). Clinical and Laboratory Standards Institute, 940 West Valley Road, Suite 1400, Wayne, PA 19087, 2003.
- Specimen collection volume for laboratory tests. Dalle JC, Ruby SG. Arch Pathol Lab Med 2003;127:162-168.
- Recommendations for detection and management of unsuitable samples in clinical laboratories. Lippi G, Banfi G, Buttarello M, et al. Clin Chem Lab Med 2007;45:728-736.

- Effect of sample aliquot size on the limit of detection and reproducibility of clinical assays. Chen G, Kobayashi L, Nazarenko I. Clin Chem 2007;53:1962-1965.