Fill Volume: What’s Appropriate?

Second only to haemolysis, insufficient sample (1,2)—not enough blood drawn to do the required tests— is the most common reason for specimen rejection and redraw.

But there’s more to the story than just getting 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 quantities and types of additives. They are designed to collect a predetermined quantity of blood in order to achieve a defined concentration of additive in the blood sample, that is, a correct blood to additive ratio. An incorrect blood to additive ratio can lead to inaccurate test results and flawed patient management.

Too high a final concentration of the additive (underfilled tube) (3) may result in preanalytical errors such as haemolysed sample (glycotic inhibitor), changes in cell morphology (KEDTA) (4), prolong coagulation times (citrate) (5), etc. Too low a final concentration of the additive (overfilled tube (6)) may result in delayed clotting or fibrin formation (serum), or inadequate anticoagulation and creation of microclots (plasma or whole blood), which, in turn, can affect instrument performance. Guidelines (7) define proper fill volumes.

Further, collection of more blood than required (8) to perform tests can lead to anemia (8) in hospitalized patients, especially newborn infants and patients in intensive care, and result in blood wastage. Through recent advances in instrument technology and the use of smaller collection tubes, most laboratories can decrease collection volumes without compromising their ability to report reliable and timely results.

Refer to published literature (9, 10) for guidance on calculating the volume of blood necessary and identifying the correct size of tube for a particular panel of tests.

Finally, phlebotomy training (11) is critical to achieve collection of the appropriate volume. Include instruction on ensuring blood flow has ceased before tubes are removed, proper use of appropriate devices (e.g., special tube manufactured as partial draw tube for fragile veins), proper techniques for syringe-to-tube transfers, etc. Also, labs will benefit from implementing quality monitoring systems (1) to catch inappropriate fills within the lab before conducting any testing, even if these systems are manual.

References: