History of the Vacutainer Tube

The different tubes are known as a vacutainer and were developed by Joseph Kleiner in 1947. The vacutainer is currently being manufactured by Becton, Dickinson and Company (BD), which is a global company providing medical supplies to the healthcare and pharmaceutical industry.

BD has facilities located in 50 countries and the birth of the company dates back to 1897, with the original founders Maxwell Becton and Fairleigh Dickinson. Since the date of the first sale, which was an all-glass syringe sold in 1898, BD has grown to be a global distributor of various different products, to include materials and equipment to collect blood samples.

Coagulant Blood Tests

Coagulant blood tests are performed to test an individual's ability to clot properly. The test is generally ordered prior to a surgical procedure, when a patient is diagnosed with a bleeding disorder, or if a patient is being treated with blood thinner medications.

- Gold or red/gray rubber top tube known as a tiger tube contains a clot activator and gel and is used for serum separation.
- Red top tube also has a clot activator and is used to collect serum to test for infectious diseases, or routine blood donor screening.
- Orange or grey/yellow rubber top contains thrombin, which is used as a rapid clot activator, used for serum testing required right away.

Anticoagulant Blood Tests

An anticoagulant is added to various different types of tubes to prevent coagulation, or blood clotting from occurring. This additive binds to calcium ions, which inhibits the proteins responsible for coagulation from acting and causing the blood to clot.

- Lavender or Pink rubber top tube contains an additive called ethylenediaminetetraacetic acid (EDTA), or potassium salt. This tube is used for full blood counts (CBC) required for blood banks, blood type screening, or blood cross-match.
- Light blue top tube contains citrate as an additive, which is a reversible anticoagulant. This additive will dilute the blood and is used for platelet function and coagulation assays.
- Green top tubes contain sodium or lithium heparin and used in chemistry for plasma determination.
- Light Green or Green/Gray top tubes are similar to the green tube in plasma determination. The difference is this tube contains lithium heparin and a gel for plasma separation.
- Grey top tube contains potassium oxalate and sodium fluoride and used for glucose determinations.
- Dark blue top tube contains sodium heparin and can also contain EDTA. It is used to analyze if there is trace metal in the blood supply.

Other Types of Tests and Tubes

There are other types of tubes used for various tests that are ordered by a healthcare professional, but are not classified as a coagulant or anticoagulant.

- Red top tube, which contains no additives, is used to test for antibodies, or for drug testing.
- Light yellow top tube contains the additive sodium polyanethol sulfonate (SPS). This tube is used for blood bank studies, human leukocyte antigen (HLA) phenotyping, DNA, and paternity testing.
- Tan top tube is used specifically to test for lead and is certified lead free. The tube contains sodium heparin or EDTA as an additive.
- White top tube contains EDTA with gel as an additive and used in molecular diagnostic testing to include polymerase chain reaction (PCR), or branched DNA.

Standard Order of Blood Draw

The order of tubes used in a blood draw is important when collecting a blood sample to prevent cross contamination in the various tubes used. The first draw is the blood culture, then the coagulation tube, non-additive tube, followed by additive tubes. There are variances in the order of tubes used in the collection and the healthcare professional is trained in the appropriate methods.

Tubes are drawn in a specific order to avoid the possibility of erroneous test results caused by carryover of an additive from one tube to the next.

If a blood culture is ordered, it should be drawn as the first tube. Additional tubes should follow this order of draw.

- Sodium citrate - coagulation tube (light-blue top)
- Serum tube - with or without clot activator or gel. This tube is either a red top tube or a gold top tube depending on manufacturer and tube additive.
- Sodium or lithium heparin with or without gel plasma separator (green top)
- Potassium EDTA (lavender or pink top)
- Sodium fluoride, and sodium or potassium oxalate (gray top)

When Using The Syringe System:

The document by the then National Committe for Clinical Laboratory Standards (NCCLS*) from 1991 established two distinct orders of draw for vaccum tube draws and syringe method. *This is now obsolete!* NCCLS revised these standards in 1998 because there was a lack of evidence that syringes need a separate order of draw.

When Using Evacuated Tubes

The order of draw according to CLSI standard H3-A6 is as follows. This order should ALWAYS be followed to prevent erroneous results due to additive crossover:

1.) Blood cultures (yellow) SPS (sterile)

2.) Light blue (buffered sodium citrate tube)

3.) Red (plain), or Tiger-Top mottled red (gel separator tube)

4.) Green heparin and light green (sodium or lithium with or without separators)

5.) Lavender (EDTA)

6.) Pink, white, or royal blue (EDTA)

7.) Gray (Na flouride/potassium oxalate)

8.) Dark blue (FDP)

REMEMBER:
*NCCLS changed their name to Clinical and Laboratory Standards Institute (CLSI) on 1 January 2005.

The current edition of the CLSI catalog and CLSI hematology standards are available upon request from either CLSI membership organizations as well as to non-members directly from CLSI.

www.clsi.org