



COMPARISON OF LAVENDER TOP VACUTAINER TO PINK TOP VACUTAINERS FOR USE IN CBC PURPOSES

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ABSTRACT

Pink and Lavender top vacutainers both utilize spray coated K2EDTA in a ratio of 1.8mg/mL. Lavender tubes are used for whole blood analysis CBC, whereas pink tubes are used for type and screening/blood banking purposes. The purpose of this study was to determine if pink top tubes can be used for CBC analysis as effectively as Lavender; and what the length of viability was for blood samples in each tube. It was determined that pink top tubes are viable for use in CBC, and that their viability time is the same as lavender tubes.

INTRODUCTION

Ethylendiaminetetraacetic acid (EDTA) is an anticoagulant commonly used in evacuated tubes.^[1] EDTA inhibits the clotting process in blood by removing and binding calcium.^[1] EDTA is in liquid form, or is sprayed, onto vacutainers used to draw blood. K2EDTA, the dipotassium form of EDTA, is used in Lavender, purple, and pink top vacutainers.^[2] Lavender/purple top vacutainers are used for whole blood hematology and immunochemistry testing.^[2] They are also used for complete blood counts (CBC).^[3] Pink top vacutainer tubes are used for cross matching and blood banking purposes of whole blood samples.^[2]

The aim of this study was to determine if pink top vacutainers can be used for CBC as effectively as lavender top vacutainers. The study was conducted at Cobleskill Regional Hospital (CRH), Schoharie County, N.Y. BD Global Technical Services, the supplier of CRH's vacutainers, was contacted. A BD technician confirmed that pink, lavender, and purple top plastic tubes are spray coated with K2EDTA. With this in mind, there is little difference between pink and lavender top tubes apart from the cosmetic differences of the tops. Pink top tubes have labels on them that allow for cross matching. It was hypothesized that pink top tubes can be used for CBC purposes as effectively as lavender top tubes. Furthermore, shelf life and viability of blood samples in both lavender and pink top tubes was observed until the tubes come back positive for morphology and are were no longer viable for CBC purposes. It was believed that samples in the pink top tubes will remain viable for tests longer than lavender top tubes.

Before conducting this experiment on a larger population seven members of the lab staff volunteered for a preliminary experiment. The preliminary results suggested that pink top tubes are just as viable for CBC analysis as lavender top tubes. It was decided to expand the study to patients and collect a larger number of samples.

MATERIALS AND METHODS

Materials

Spray coated K2EDTA lavender top vacutainers from BD; 4mL volume tubes with hemogard. Spray coated K2EDTA pink top vacutainers from BD; 6mL volume tubes with hemogard. Tubes were supplied and ordered directly from a BD supplier. Medline alcohol antiseptic prep pads were used to clean the needle insertion area. Either Nipro straight blood collection needles or BD safety-lok blood collection "butterfly" needles were used; depending on patient preference. Butterfly needles were used more commonly than the straight needles. BD vacutainer holding tubes were used to hold the tubes/needle.

Instrumentation

A Sysmex XT-2000i Hematology Analyzer was used for CBC analysis. The instrument was set up and calibrated to run 4mL tubes in automated mode; not 6mL. As such most lavender tubes were run in automated mode; whereas all 6mL pink tubes had to be run in open mode. Several lavender tubes were run in open mode one night when automated mode failed to operate. However: it was noted by the technologists that the differences in results between open and closed modes were negligible.

Blood collection

Patients who came into the lab for blood work were used for the sample collection pool, as well as several members of the lab who were willing to participate. Patients who had a lavender tube already scheduled to be drawn were informed of the study and its purpose. They were then asked if they were willing to participate by allowing an extra tube to be drawn from them in the form of a 6mL pink top vacutainer. Patients who declined were thanked for their time in listening. Patients who agreed to participate in the study were handed an informed consent form containing information about the study. Patients signed at the bottom, indicating their willingness to participate. They were also given a sheet to take home about the study.

Patients were otherwise treated in the same manner that regular, non-participating patients are at CRH. Patients are usually asked what kind of needle they would prefer, so there was some variation in types of needles used.

Procedure

A total of 34 persons participated in the study; 68 tubes total. The tubes were collected over a period of four weeks. To replicate lab situations the tubes did not have the first CBC run on them until a technologist was available to do so; the tubes were not given initial priority over others. Once a participant's lavender tube showed up to be run for CBC its pink top counterpart was usually run within thirty minutes of that time. CBC was run on all 68 tubes. It was preferred that the tubes have CBC with diff, retic, and IRF done in order to break down the white blood cell (wbc) category more descriptively. Most of the tubes had this done. However, several tubes were unable to have diff, retic, and IRF added to regular CBC due to time constraints, or simple failure to select them. The initial CBC run was labeled time "0" even though the samples may not have been run immediately run after drawing. The preliminary study showed that most of the tubes' blood had a viability of between twenty four and 48 hours for CBC without the results coming back positive for morphology. With this in mind it was decided to run CBC on the samples every twelve hours. The time that the first CBC was performed on each tube was noted. It was expected that the tubes should have CBC run on them again every twelve hours after this time. However, since CRH is an actual hospital running tests on real patients' samples, a +/- one hour allowance was utilized; recognizing that the technologists might be busy when the samples were supposed to be run. Most CBC runs fell within this +/- one hour window. Some fell slightly outside of that time frame on particularly busy days in the lab, but since the pink and lavender tubes for each respective patient were run at the same time it was decided that these times fell within an acceptable variance. Lavender vacutainers were run in automated closed mode, pink in open mode on the XT-2000i hematology analyzer. Printouts were collected for each sample and labeled according to patient assigned number

and tube color. For example, patient participant number one's lavender tube was labeled "Lavender 1." This method of CBC and labeling was performed for all 68 tubes. CBC every twelve hours was stopped after 48 hours. This was due to noticing during the study that many of the tube's CBC came back positive for morphology somewhere between 36 and 48 hours. After all 68 tubes had been run the results were compiled for comparison.

RESULTS

White blood cell (WBC), red blood cell (RBC), hemoglobin (HGB), hematocrit (HCT), mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC), Platelet (PLT), neutrophil (NEUT), lymphocyte (LYMPH), monocyte (MONO), eosinophil (EO), basophil (BASO), and immunoglobulin (IG) concentrations for each of the 68 tubes was compiled for comparison. An average, standard deviation, mean, median, and mode was taken for each tube (i.e. lavender 1). This showed general information about each individual sample and its variation in CBC results at 0, 12, 24, 36, and 48 hours. The lavender and pink tube for each patient were compared to each other. This was done by subtracting CBC values of the pink tube from the same CBC value of the lavender tube at the same respective time. For example, the difference in RBC concentration between pink 1 and lavender 1 at 0 hours was $0.08 \times 10^6/\mu\text{L}$. The differences in concentrations between pink and lavender tubes from the same patient were calculated for all 34 patients. This was done on an individual patient basis due to the fact that among people there is wide variation of concentrations in the blood from contributing factors such as age, weight, general health, illness, pregnancy, genetic factors, etc. To find averages at each time for all 34 lavender tubes and all 34 pink tubes and then compare would not properly show the differences between the two tubes. The comparison of lavender vs. pink tubes for an individual patient at 0, 12, 24, 36, and 48 hours created a large amount of data that has to be seen, but gives better insight to variation in CBC results based on tube differences, and reduces other competing factors. See appendix A for full results.

DISCUSSION

Out of 34 pink top samples 1 was positive for morphology between 12-24 hours, 11 more were positive between 24-36 hours, and 9 more were positive between 36-48 hours, making for a total of 21 out of 34 tubes that became positive for morphology by 48 hours. The other 13 tubes had not yet come back positive for morphology by 48 hours. To contrast this, 2 lavender tubes were positive between 12-24 hours, 11 more were positive by 24-36 hours, and 8 more were positive by 36-48 hours, making for 21 out of 34 lavender tubes also having become positive for morphology by 48 hours. From these results it was concluded that blood in pink top tubes has the same viability time as lavender tubes. It

appears that blood samples in K2EDTA can have CBC tests run on it for up to 36 hours, but any time after that greatly increases the likelihood of samples becoming positive for morphology. With roughly 1/3 of the samples having gone bad by 36 hours, it is recommended that CBC be run by the 24 hour mark. It is important to note that even when samples came back positive for morphology, the differences in concentration, volume, and other values were minimal. This is likely due to overall amount of RBC, WBC, PLT, etc. not changing in number. However, morphology of the materials in the blood did begin to change, so it was concluded that even though concentration numbers had not drastically changed the samples were no longer viable for CBC due to them morphing.

WBC were usually the first component of the blood to morph and cause the sample to come back positive. RBC, HGB, HCT, MCV, MCH, and MCHC were all very stable; rarely ever changing in morphology over the 48 hour period, if at all. Post 48 hours it could be possible to observe components of the blood apart from WBC and still get fairly accurate results. It makes sense that WBC morph first. RBC are known to be much more stable than WBC and have a much longer lifespan.

After subtracting the concentration of the lavender tube from its pink counterpart it is clear that the values are very close. The differences in values were very little. This suggests that pink top vacutainers can be used as effectively as lavender vacutainers for CBC. Pink top vacutainers have the same ratio of K2EDTA as lavender, so it would make sense that they could be used for CBC. The differences in values between pink and lavender tubes were not enough to be considered significantly different. Once again, with these results it was concluded that pink top tubes can be used for CBC analysis as effectively as lavender.

The importance of this could be very significant. Many patients come into the hospital with workups requiring both pink and lavender tubes to be drawn from them. The lavender is often for a CBC, HH, or other test. The pink is for blood banking. Since the results confirm that pink tubes can be used for CBC, this would mean that such patients would no longer need to have two tubes drawn. Instead CBC tests and blood banking could be consolidated into just one 6mL pink top vacutainer. This would mean that instead of giving 10mL of blood (4mL from lavender and 6mL from pink) patients would give only 6mL. During the preliminary stages of the study 2mL pink top tubes from BD were used. It was found that these tubes often short draw, take too long to fill which could possibly increase patient discomfort, and seem to have a shorter length of viability than pink or lavender tubes. These results led to discarding 2mL as an option for alternative CBC tubes.

The consolidation of these tests to only one tube would also reduce the amount of time a patient would be having

their blood drawn; thus reducing discomfort to the patient by having the needle in their arm for less time. Consolidating tubes would also decrease use of tubes, reducing hospital costs. An issue does arise with time management in the lab however. Most CBC analyzers are set up for 4mL tubes. 6mL tubes will not fit the automated closed mode system unless a trained technician from the instrument company comes to recalibrate the analyzer to take 6mL tubes. 6mL tubes can be run in open mode, but this requires the technologists to be at the machine longer and takes more time than closed mode. If a hospital has more than one analyzer it might be beneficial to have one set for 4mL tubes and the other for 6mL. If a hospital has only one analyzer it would be up to them to decide if they should switch the instrument to 6mL size.

Another issue could arise in labeling. Many hospitals require that pink top tubes for blood banking be hand labeled, whereas automated/open mode for CBC on the sysmex analyzer utilizes a bar code with patient information. CRH placed a bar code label opposite to the hand label on a pink top tubes in order to counter this as a test for the study. The tube ran through the analyzer with no problems. Whether other hospitals are willing to utilize this method of labeling is up to them.

During the course of the study concern rose that running CBC might introduce contamination that would interfere with blood banking. A brief study was conducted on several pink top tubes. CBC was ran on the tubes, then blood banking. The results showed that running CBC on pink top vacutainers does not introduce interference in blood banking.

It is important to note that on several occasions CBC was unable to be run at certain times on the tubes. Some of these were due to the lab being busy, a misunderstanding of time schedule, or on one occasion a malfunction of the sysmex 2000i instrument. Most of these errors occurred at the 12 hours after initial CBC time. The preliminary study already showed that at this time all of the pink and lavender tubes were still viable and yielded similar results that agreed with each other. As such, while it is unfortunate that a comparison between these particular pink and lavender tubes at 12 hours could not be performed, it was decided to continue use of these tubes due to time constraints and difficulty in obtaining enough patients for the study.

In conclusion, the hypothesis that pink top tubes are viable for CBC was confirmed, and that they have a length of viability that appears to be the same as lavender tubes. It is hoped that these findings will be used to reduce hospital costs, consolidate tests, increase efficiency, and reduce patient discomfort in the lab. On several occasions during this study time slots were missed and samples failed to be run. This was often due to time constraints with the technologists, who were busy running patient samples. CRH is an active hospital with

patients coming in daily for blood work. Patients take priority over a study in every case, so it was accepted that timing difficulties may occur. With this in mind, if this study were to be repeated it may be pertinent to have one or two techs assigned to the study only, perhaps designate a particular analyzer for study purposes, or simply conduct the study in a non-hospital lab where the influx of patients might not be as much of a problem.

REFERENCES

1. Patel, Nayana. (January). Tech Talk. BD Global Technical Services. Retrieved 12/17/13 from <http://http://www.easybib.com/reference/guide/apa/website, 2009>.
2. Lenco Diagnostics Laboratory Inc. Tube Guide. Lenco Diagnostics Laboratory. Retrieved 12/17/13 from http://http://www.lencolab.com/doctors/tube_guide.html
3. Vacutainer Tubes Technical information and supplier details. M/s Sanjay Projects and Instrument Co. Retrieved 12/17/13 from <http://http://www.vacutainertubes.com/home/functional-classification-and-colour-codes>