

Answering your questions

Quality of skin puncture CBC

Q We have clinics where nurses are collecting and running CBCs on a Coulter using fingersticks only, which can result in a less than optimal sample. Even though the nurses have been trained on collection and other processes, many of the samples they run through the machine have erroneous results, probably due to clots or excessive squeezing of the puncture site. Is there any information we can show the nursing staff and physicians that states it is preferable to run CBCs from a venipuncture rather than a fingerstick?

A A complete blood count (CBC) and other blood parameters can be obtained from blood collected by either venipuncture (venous blood) or skin puncture (fingerstick or heelstick; capillary blood). Adhere to the recommendations of the manufacturer of the specific analyzer. No explicit recommendations stating the superiority of one method over the other are made by the Clinical and Laboratory Standards Institute (CLSI), with certain exceptions. CLSI states, "Blood specimens obtained by skin puncture are especially important in pediatrics, because small but adequate amounts of blood ... can be obtained ..."¹

Venipuncture used to obtain blood for analysis is potentially dangerous in infants. Furthermore, "It is also advantageous to obtain skin puncture specimens from some adult patients."¹ This includes severely burned, extremely obese, and geriatric patients, along with patients with thrombotic tendencies, inaccessible superficial veins or fragile veins, and patients performing tests at home or tested at point-of-care. This list implies that in most adult patients the preferred method of obtaining a blood sample is venipuncture.

It is preferable to run CBCs from a venipuncture rather than a fingerstick due to following reasons:

a) Venipuncture provides for larger blood-specimen volume.

b) The technique of venipuncture appears to be less prone to producing a suboptimal specimen due to its less complicated character. There is, for instance, the requirement to have the disinfectant completely air dried before proceeding. If this is not adhered to, significant hemolysis may occur, which will distort the results of a smaller (skin puncture) blood volume much more severely than those of a large (venipuncture) volume. It is also paramount to discard the first blood drop in skin puncture, since it will be diluted by extracellular fluid. Squeezing of the puncture site is to be avoided because it causes hemolysis and dilution by extracellular fluid.

There are controversial results concerning different CBC values and chemistry parameters between fingerstick and venipuncture blood.

c) Another reason to prefer venipuncture (in adults) may be the fact that reference intervals were most likely determined using this method. There are controversial results concerning different CBC values and chemistry parameters between fingerstick and venipuncture blood. The CLSI guidelines show that some chemical constituents have values in capillary blood that differ from those in venipuncture blood. One study shows no significant differences between capillary and venous blood values for numerous parameters included in the CBC,² whereas other authors find significant differences.³

d) Venipuncture samples provide more reliable results, since all these studies have shown that venous-blood results have less variation and better precision.

In summary, venipuncture is the preferred method of blood sampling in

most adult patients. If an erroneous CBC result is suspected and post-collection (laboratory) problems have been ruled out by adequate QC and QA procedures, venipuncture is recommended.

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—Guang Fan, MD, PhD

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References

1. Clinical and Laboratory Standards Institute. *Procedures and devices for the collection of diagnostic capillary blood specimens; Approved Standard - Fifth Edition*. Wayne, PA: CLSI; 2004: Vol. 24, No. 21.
2. Stuart J, Barrett BA, Prangnell DR. Capillary blood collection in hematology. *J Clin Pathol*. 1974;27:869-874.
3. Yang Z-W, Yang S-H, Chen L, Qu J, Zhu J, Tang Z. Comparison of blood counts venous, fingertip and arterial blood and their measurement variation. *Clin Lab Haematol*. 2001;23:155-159.

Differentiating cells in UA

Q In our urinalysis lab, we have some difficulties in the differentiation of renal epithelial cells from transitional epithelial cells. Even when reading more information about them and looking at photos from different atlases, we still have doubts. We read that sometimes it will be difficult to differentiate, especially for cuboidal renal epithelial. The origin of the cell is another factor. We also correlate with other findings in the urinary sediment. Is it acceptable to report the quantity of "non-squamous epithelial cells" when doubts arise? What do you recommend?

A Renal cells are difficult to identify accurately in wet-microscopic urinalysis and can often be mistaken for leukocytes, histiocytes, granular casts, deep urothelial cells, and squamous metaplastic cells. There are important differences between renal epithelial cells and deep urothelial cells that relate to the shape and texture of the cytoplasm.

Deep urothelial cells are round,

have a centrally located nucleus with a cytoplasm that is often homogenous and displays an endo-ectoplasmic rim. Renal cells are polygonal, elongated, as well as a variety of shapes, with a central or eccentrically located nucleus and a cytoplasmic texture that can be finely granular to coarsely granular. The *origin* of renal cells cannot be determined in wet-microscopic urinalysis and requires confirmatory methods such as cytodagnostic urinalysis to characterize the renal-cell types and their origins.¹

It is important to state “*suspect renal cells*” on the report form or in discussions with the pathologist or requesting physician. Therefore, stating “non-squamous epithelial cells present” is inadequate and can be misleading. Without accurately reporting suspect renal cells, clinical laboratory scientists will never be able to properly detect and prevent the early stages of renal failure.

—G. Berry Schumann, MD (deceased)
Former medical director at Schumann
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Reference

1. Schumann GB, Friedman SK. *Wet Urinalysis, Interpretations, Correlations and Implications*. Chicago, American Society of Clinical Pathologists, 2003.

Tube type for plasma samples

QI have a blood bank question. According to the AABB technical manual, you can use either serum or plasma for antibody screening and cross matching. They do not mention the tube type. We occasionally get patients with a lot of fibrin and have to pre-warm; if we could use plasma, it would avoid that procedure. Can you help me find where it indicates tube type?

AThe question appears to ask what tube type is best for preparing plasma samples for antibody screening and cross matching. As the questioner points out, the AABB technical manual states that such testing can be done using either serum or plasma.¹ In most cases plasma is sufficient, except, for example, in some adsorption studies and would be necessary in testing that required complement such as the Donath-Landsteiner test.

In addition, the use of plasma can simplify testing by avoiding formation

of clots. In most cases, our lab prefers to use plasma obtained from EDTA collection tubes.

Although the AABB does not specify a particular tube type, the Food and Drug Administration (FDA) does require the tubes used for immunohematology testing to be cleared for that use by the FDA (i.e., 510(k) compliant). Recently, this has meant that plastic tubes, which have often been instituted for safety reasons, must be compared to prior standards.

Even when tubes are 510(k) certified, additional validation testing should be performed in-house to ensure a new tube type will work under conditions in a particular lab.

Few studies have been done to compare specific tube types in the literature. Anderson and colleagues performed a study specifically comparing plastic and glass test tubes from one manufacturer for plasma and serum collection. They showed the two tube types to be in agreement for ABO and Rh typing.² Similar data can also be found on the FDA website and from test-tube manufacturers.

Serum-separator tubes should be specifically avoided in performing immunohematology testing due to issues of false-positive results.³ A synopsis of issues related to the use of this system can be found at the e-Network Forum of the California Blood Bank Society.⁴

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References

1. Shulman IA. Pretransfusion Testing. In: Roback JD CM, Grossman BJ, Hillyer CD, eds. *Technical Manual*, 16th ed. Bethesda: AABB, 2008.
2. Anderson DR, Wiseman J, MacLeod J, et al. Evaluation of polyethylene terephthalate for ABO and Rh typing and alloantibody screening. *Transfusion*. 2000;40(6):669-672.
3. Geisland JR, Milam JD. Spuriously positive direct antiglobulin tests caused by use of silicone gel. *Transfusion*. 1980;20(6):711-713.
4. Shulman IA, ed. In: California Blood Bank Society e-Network Forum: www.cbbsweb.org/enetcommun.html. Accessed: May 13, 2009.

Escherichia coli in urine specimens

We have a relatively small hospital and micro lab but do test for shiga-toxin-producing *E coli* (STEC) in stools. We are currently testing within Centers for Disease Control and Prevention recommendations. My question: Is there significance in finding *E coli* O157 in urine specimens? We have an occasional urine isolate panel that pops up an alert for possible *E coli* O157. We send these isolates out to the state lab for shiga testing, and they have always come back as negative for shiga toxin. We do not do shiga-toxin testing on urines here and wondered if we need to continue with sending them out. Any thoughts?

AMany automated instrumentation will alert to possible *E coli* O157 in their identification schemas. *E coli* O157 and the other shiga-toxin-producing *E coli* serogroups, however, are found only in the gastrointestinal tract, not in the urinary tract.

The profound effects of infection with a shiga-toxin-producing *E coli*, including hemolytic uremic syndrome (HUS), come from the cytotoxins (shiga toxins) produced by these organisms. It is the shiga toxins that cause the disease in the gastrointestinal tract, not the presence of the organism itself. The toxins may bind to leukocytes and be distributed throughout the bloodstream. Endothelial cells can be affected by these bloodborne toxins leading to HUS.¹ You should not need to send urinary isolates for shiga-toxin testing. □

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Reference

1. Donnenberg MS. Enterobacteriaceae. In: *Principles and Practices of Infectious Diseases*. 6th ed. Mandell GL, Bennett JE, Dolin R, eds. Elsevier Churchill Livingstone. Philadelphia, PA; 2005:2576-2577.



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