What bloodwork tells you about your horse

Before you can understand what blood tests are and how they can help diagnose ailments in your horse, it's a good idea to understand some of the basics about the study of blood–hematology.

Blood tests are a part of veterinary medicine known as laboratory medicine. This branch of medicine is used by your veterinarian–along with physical examination findings–to aid, confirm, or disprove a suspected diagnosis.

When all is normal, most of the components of blood are regulated to a very narrow concentration that varies only slightly from horse to horse. Because of that fact, a reference range for what is normal is available for comparison. Many blood components change in a very predictable way relative to a disease process; therefore, blood tests can be extremely valuable aids in disease diagnosis and determining health status.

The RBC's main function is to carry oxygen throughout the body, while the various WBCs mainly carry out immune system functions. The red and white blood cells are manufactured within the bone marrow and released into the bloodstream. A small quantity of red and white blood cells are manufactured in the spleen. Platelets are cells that function in blood clotting, and are also manufactured in the bone marrow.

The main protein in the blood is albumin, which is manufactured in the liver, as are other proteins, including ones involved with blood clotting. One example is fibrinogen.

Hematology is used to examine a horse's red and white blood cell counts. The common name for evaluating these components of the horse's blood is a complete blood count or CBC. The first test in this category is the packed cell volume or PCV (also called hematocrit). The PCV is the percentage of red blood cells compared to the liquid component of blood, called the plasma. A low red cell mass would indicate anemia, and an increased red cell mass would indicate dehydration (or an overproduction of red cells, which is extremely rare in the horse). There are many causes of anemia (low red blood cell count), including

chronic parasitism, blood loss, and chronic inflammation.

This reminds us that a single laboratory test only helps a little with finding the cause of a problem, but when used in combination with other tests and clinical examination, the puzzle can become more clear.

For example, with chronic parasitism there is often weight loss and a low blood protein concentration, and with chronic inflammation there might be low-grade fevers and an increased blood protein concentration. Hemoglobin (the protein within the RBC that contains iron) is normally 10-18 grams per deciliter of blood; a low hemoglobin level in conjunction with anemia would be an indication of iron deficiency anemia. The more common cause of iron deficiency anemia is not dietary, but chronic inflammation or the "anemia of chronic disease" (iron is tied up in the infection-fighting processes of the immune system).

Looking at the total WBC count and the differential can help diagnose various types of inflammation. For example, with severe acute inflammation/infection, the WBC count might decrease with the appearance of immature neutrophils. With more slowly developing or chronic inflammation/infection, the total WBC count tends to increase. With allergic-type inflammation, increases in the numbers of eosinophils and basophils might be noted. The monocyte is the "clean-up" cell of the body, so with chronic inflammation there usually is an increase in the number of monocytes. The WBC count is also useful in determining if you are getting a response to treatment. For example, with a mild/ moderate case of pneumonia, you would expect an increase in the WBC count. If the antibiotic of choice is correct, you would expect–in addition to improvement in the clinical signs–the WBC count to decrease toward the normal range.

If the infection is extremely intense and involves a vigorous bacteria (or virus), the WBCs are consumed rapidly and the total count decreases because consumption exceeds production. With less intense and more chronic infections, the WBC count increases. Blood testing can provide important information, but it almost always needs to be interpreted relative to the clinical examination findings, history, and additional testing in order to arrive at an accurate diagnosis of the problem.

CHEMISTRIES

Remember that blood is approximately 60% water and approximately 40% red

and white blood cells, with the rest of “blood” containing hundreds of elements, electrolytes, enzymes, and proteins.

We are now interested in some of the components in the blood’s “serum.” The serum is the clear-to-yellowish fluid remaining after the blood sample is allowed to clot and has been centrifuged (spun so that the red cells are removed). The serum contains electrolytes, a variety of proteins, enzymes, and many waste products of metabolism.

The first components measured in a blood chemistry profile are typically the electrolytes sodium, potassium, and chloride. The major function of electrolytes in the body is electrical in nature. For example, when a nerve ending is stimulated, the signal is transmitted to the brain, spinal cord, or muscle by the movement of sodium across the nerve cell membrane. Another example is the collection of cells controlling the trigger for contraction of the top part of the heart (the atria); the signal also depends of the movement of sodium across the cell membrane. Potassium also is closely involved with nerve conduction and muscle contraction.

Electrolytes can also be “lost” through severe or chronic diarrhea or kidney dysfunction.

Another relatively common cause of electrolyte changes (particularly potassium) is a ruptured bladder in foals. The potassium in urine is absorbed into the bloodstream via the lining of the abdominal cavity–a clinical sign of high potassium is an abnormally low heart rate (bradycardia). Electrolyte alterations also can be caused by severe sweating.

The next components often measured in a chemistry profile include calcium, phosphorus, and magnesium. These electrolytes are very important in bone health and muscle contraction.

Changes in these electrolytes can be related to diet, various illnesses, sweating/dehydration, kidney dysfunction, and other problems. For example, the inflammatory intestinal disease caused by the blister beetle (cantharidin toxicity) is often associated with a decrease in serum calcium.

Phosphorus and/or magnesium increases or decreases are typically associated with extreme dietary imbalances.

PROTEINS

Serum protein is an important component of a serum chemistry profile that is typically differentiated into the two “main” proteins (there are many others in relatively small concentrations), the albumin and globulins. Albumin is a protein manufactured within the liver that is mostly responsible for water balance within the blood system. Typical causes of decreased albumin include kidney disease, a decrease in albumin production by the liver, or a malabsorption condition of the gastrointestinal system (sometimes caused by chronic parasitism).

Globulins, or immunoglobulins, are the proteins of the immune system. A common cause of increased globulins is excess production stimulated by chronic inflammation or infection–a long-standing chronic abscess is often a cause of increased globulins Two commonly measured enzymes are SGOT–standing for serum glutamic oxaloacetic transaminase (also called AST)–and CPK (standing for creatine phosphokinase), which are the muscle enzymes.

Elevations of CPK and SGOT are indictors of muscle inflammation–tying-up or rhabdomyolysis. The term “rhabdo” means muscle and “myolysis” means rupture of muscle cells.

The CPK and SGOT are very sensitive indicators of skeletal muscle damage, and they rise in concentration proportionally with the amount of damage. A bit of timing is required in order to obtain the most sensitive results; CPK rises (due to its leakage from muscle cells into the blood system) approximately six to eight hours after the onset of muscle inflammation, and SGOT rises after approximately 12-14 hours. The absolute peak of CPK concentration and the time it takes to return to normal are important indicators of the severity of muscle damage and the response to therapy.

The next compound is creatinine, which is a waste by-product of muscle metabolism that is eliminated very efficiently via the horse’s kidneys. The serum concentration of creatinine is directly related to kidney function; therefore, an increase in serum creatinine is an indicator of renal insufficiency. Creatinine monitoring is useful for a variety of illnesses and conditions that can affect kidney function. For example, severe cases of tying-up can release the protein myoglobin into the blood system, which can be toxic to the kidneys. Monitoring creatinine evaluates how well the kidneys are coping and if additional treatment is

necessary.

The next two take a look at liver function. The enzymes SDH (sorbitol dehydrogenase) and GGT (gamma-glutamyltransferase) are associated with liver function. Diseases that cause liver damage or inflammation cause an increased serum concentration of SDH and/or GGT.

Another liver-related compound is bilirubin, which is a compound secreted by the liver into the intestine to aid in digestion. Increases in serum bilirubin concentration can be caused by bile duct obstruction via infection and occasionally even bile stones (gall stones in humans, but horses don't have gall bladders). Due to the lack of a gall bladder, rises in serum bilirubin concentration can also be caused by relatively short periods of being off feed. Increased serum bilirubin is responsible for the yellowing of skin (jaundice or icterus) often observed with liver disease or hepatitis. Of course, there are more blood tests than can be discussed in this one article, but these are the ones horse owners will most often hear about when they have a sick or injured horse. Remember that some of these tests will need to be done repeatedly over a period of time to see if the levels of various substances in your horse's blood are rising or falling as an indication of whether he's getting better, or worse. If you have questions about specific tests done on your horse, ask your veterinarian.