"Why Equine KidneysRarely Fail"

By Joanne Meszoly

**A sophisticated waste-processing system**

Situated on either side of the spine, just beneath the last few ribs and slightly behind the area that your saddle covers, your horse's kidneys function very much like a waste-water treatment plant. Protected from impact and injury by a cushioning layer of fat, a layer of bone and several inches of muscle, the two purple organs, each weighing about a pound and a half, sort through the various substances carried in the blood, conserving those that your horse needs to survive and disposing of those that could do him harm. As the kidneys carry out their basic filtration duties they also monitor and regulate fluid volume and composition. They promote red blood cell production, modulate blood pressure and control the blood's pH (acidity).

Blood arrives in the kidneys via the renal artery—a branch of the aorta—and is processed in two layers of kidney tissue that lie beneath the organs' skinlike covering. Within the tissue, more than a million microscopic units called nephrons handle the purification duties. Only about 25 to 30 percent of the nephrons actively process fluid full-time. The remainder stand by in case of an increase in blood flow, which may be triggered by illness, excitement or cold temperatures. Additional nephrons also may be called into service when a horse consumes more water than usual.

Each nephron begins at a tuft of capillaries on one of the tiny branches of the renal artery. Known as the glomerulus, this tuft is surrounded by a cup-shaped funnel, called Bowman's capsule, that receives the watery part of the blood for processing. Molecules of protein, fats and blood cells that are too large to fit through the filters of Bowman's capsule are rejected and remain in the circulation for other destinations. The fluid that passes through the capsule then moves into a long winding tube called the loop of Henle. Here, appropriate amounts of salt, potassium, sulfate, phosphate, glucose and amino acids are extracted and returned to the blood to replenish deficits. Water that is needed by the circulatory system is absorbed at the end of the nephron, and waste substances, such as creatinine, urea, uric acid, pigments and excess salts and water, are sent to the bladder to be discharged. Almost 99 percent of the filtered blood is reabsorbed, while the remaining blood constituents are unwanted and excreted in the urine. Any potential waste that proves too large to fit through the kidneys' tubes is rerouted to the liver or the gut wall, where it is processed for excretion with solid feces. The entire blood volume (on average, about 9 gallons) passes through the kidneys more than 60 times in 24 hours.

**Signs of system kidney failure**

In those relatively rare instances when kidney function is disrupted, waste products accumulate in the blood and eventually poison the system. Yet a horse with the usual subacute or chronic kidney dysfunction usually seems more "off" than ill. He may be a little lethargic or depressed. He may have a little less appetite and his performance level may not be up to par. His coat may lose some of its usual luster. Unfortunately, these signs appear only in the later stages of most kidney disease, and can easily be attributed to another illnesses. Taken together, however, poor performance, lethargy or depression and a rough coat earn a careful investigation for kidney disease.

Other signs of kidney dysfunction include:

**Abnormal urination.** A healthy, resting horse consumes an average of 5 to 7 gallons of water a day, and produces anywhere from 1 to 3 gallons of urine. In contrast, a horse with kidney disease may pass a flood of urine no matter how much liquid he consumes. He may drink no more water than usual or he may seem unable to quench his thirst. Whatever the case, his damaged kidneys cannot conserve water and they may purge the body of fluids during times of distress. Instinctively, the horse will usually drink more water to help maintain an adequate level of hydration or to flush out accumulating waste products. His urine may be strong smelling or discolored due to a concentration of waste products, or it may be as pale as light beer.

**Weight loss.** An increase of wastes in the blood can have an appetite-suppressant effect, so the horse eats less. The wastes accumulate because the kidney cannot properly retrieve essentials or secrete excess chemicals.

**Excessive dental tartar or gingivitis**—an inflammation of the gums—can be a sign of that excess urea and ammonia circulating in the blood.
If these signs always followed a distinct pattern, perhaps veterinarians would find it easier to diagnose equine kidney disease. But there is no textbook progression that points to kidney damage, and one sign can crop up long before others appear.

"Chronic renal failure has an insidious onset and usually shows up as chronic weight loss," says Harold Schott, II, DVM, PhD, a specialist in equine kidney function at the University of Michigan. "That's the number-one complaint, but weight loss could mean anything. Sometimes the owner will complain of increased water consumption and might not recognize that the stall is wetter than usual. It's easier to detect more urine with smaller animals." Schott adds that a horse with kidney disease might also begin to "feel punky" as more and more waste products accumulate in the bloodstream.

Veterinarians categorize kidney disease based on the length of time the signs of illness have persisted and the severity of the disorder. **Acute renal failure** is a temporary and sometimes curable form of kidney disease. Its onset is triggered by a sudden cessation of waste excretion, accompanied by electrolyte and water imbalance. According to Schott, acute renal failure is most often caused by a loss of blood volume due to colic, diarrhea, hemorrhage or severe dehydration. Ingested toxins and antibiotics administered to a dehydrated horse also may contribute to the onset of the condition.

In contrast, **chronic renal failure** affects the kidneys progressively, gradually destroying more and more of the cells needed to regulate fluids and excrete wastes. Chronic renal failure can follow acute renal failure if a case of acute renal failure is not treated. Chronic renal failure also can result from toxic poisoning, or glomerulonephritis--inflammation of the capillary tufts at the top of each nephron.

**How kidney function is compromised**

In many cases, renal failure is identified while a horse is receiving treatment for another illness, such as colic or diarrhea, that reduces blood pressure or otherwise distresses the function of all of the internal organs. When blood pressure drops or the body's vital support systems are stressed, the kidneys cannot remove nitrogen and other waste products from the blood; nor can they maintain adequate levels and balances of water and electrolytes. Kidney disease also occurs when the organ is damaged. Conditions and substances that can harm the kidneys include:

- **Dehydration** due to diarrhea, excessive sweating or simply a lack of sufficient water to drink. As the body's fluid level declines so does blood pressure. The kidneys lose the driving pressure necessary to separate water from the blood solids. Kidney damage can occur within hours of the initial stage of dehydration.
- **Heatstroke**, which has the same effect on the kidneys as dehydration. Marked by a cessation of sweating and an extremely high body temperature, heatstroke often results from physical exertion. During strenuous exercise, blood flow is deflected from the kidneys to serve the hardworking muscles. During ensuing heat stroke, blood is deflected to the skin and lungs.
- **Natural toxins** found in certain plants, such as wild and cultivated onions, bracken fern, white snakeroot and withered red maple leaves. The toxic substances damage the cells that retrieve or reject the constituents routed through the kidneys. When the cells are disabled, the loop of Henle cannot distinguish what to absorb or excrete. As a result, wastes remain in the body or are washed out with valuable substances in a flood of unsorted blood fluids. Just a few ounces of leaves or root are enough to cause serious illness, but cases of such poisoning are rare since most horses will avoid these plants if they have other grasses to eat.
- **Aminoglycoside antibiotics, nonsteroidal anti-inflammatory drugs (NSAIDs), vitamin D and vitamin K.** Usually beneficial to horses, these substances are toxic in high doses, but incidents of such poisoning are rare. Dangerously high doses of vitamins D and K are possible only through injection.
- **Mercury.** Highly toxic to horses, mercury was once used as a skin-blotting agent, and horses would ingest it by licking it off of their inflamed legs. The substance is no longer routinely used, so horses have little opportunity to come into contact with it.
- **Massive blood loss** from a serious wound or other injury that causes an immediate and drastic drop in blood pressure, which, in turn, diverts critical blood flow from the kidneys.
- **Shock,** which depresses blood flow to the kidneys, slowing the filtration process.
- **Colic,** which stresses all of the body's vital organs and can result in the formation of clots in the blood. These clots may clog the kidneys, trapping toxins in the body.
- **Bacterial infection,** which can damage the kidney cells. The resultant inflammation may affect the tubules to the point where plasma water can no longer pass through.
Chronic urinary obstruction, which can damage the kidneys over time, but is very rare; a kidney stone or tumor can block urination without damaging the organs.

Diagnosis and treatment

The kidneys’ obscure position within the body makes it difficult to view them with X-rays, ultrasound or an endoscope, but testing their condition is relatively easy. By taking a blood sample and a urine sample at the same time, a veterinarian can compare the levels of creatinine (a muscle-energy waste product), electrolytes and enzymes. An excessive amount of waste products in the blood or nutrients in the urine may point to irregular kidney activity. Elevated creatinine levels do not occur until 70 percent of the nephrons in both kidneys are severely damaged. The range of a normal creatinine level is less than 1.8 to 2.0 mg/dL. Severe kidney dysfunction is marked by levels as high as 15 or 20 mg/dL.

"If we can maintain it at a level that is less than 5.0, the horse may do well for several years," Schott says. "When it starts to get above 5.0, and we can't get it lower, that is usually an indication that the horse has only a few months to live."

The blood test of a horse with some degree of kidney dysfunction may also reveal signs of anemia, due to the destruction of red blood cells. Excess calcium may also appear in blood samples if the kidneys are unable to excrete the mineral.

Recovery from the condition generally depends on the underlying cause, the length of time the kidneys have suffered and the horse's response to treatment. At all stages of kidney disease the goal of treatment is to lighten the kidney's workload. In the case of acute renal failure, the first order of business is to treat the cause whether it's colic, shock or dehydration. Chronic renal failure, however, creeps up over months or years at a time, without detection, and is extremely difficult to treat.

Surgery is rarely performed due to the difficulty in reaching the kidney through the ribs and diaphragm. It is attempted only in cases of extreme cases, such as cancer, and on only one kidney.

The most important step in improving kidney condition is to replenish fluids, and some affected horses may require the administration of intravenous fluids. Any horse with kidney damage needs an unlimited supply of fresh water, as well as access to salt and electrolytes. If the horse shows signs of anemia or insufficient production of red blood cells, vitamin B complex and anabolic steroids may help boost cell production and prevent muscles from wasting away.

Since reducing stress on the kidneys is paramount, supplying an easily digested diet with low protein and low starch will help to ward off further damage. Replace grain with a soluble fiber, such as bran, beet pulp or low-protein corn. Steer clear of stemmy, coarse hays like alfalfa and clover, which tax the digestive system. For roughage, try a grass hay, such as timothy, which is low in calcium.

Studies show that horses who are able to eat well and overcome the weight loss associated with kidney disease have a better chance of recovering. With nutritional changes and a well-planned exercise schedule, a horse can continue performing despite a kidney disorder.

Perhaps if they were less resilient and whole lot less dependable, your horse's kidneys might capture a bit more of your attention. As it stands, they work without notice or recognition--and we're grateful: That's the way it should be.

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