

Salmonellis In Horses

by: Heather Smith Thomas

Salmonellosis affects humans, horses, most mammals, and birds. It can cause debilitating--and even deadly--diarrhea. *Salmonella* bacteria can affect both foals and adults, and they spread easily by horse-to-horse contact and by fomites (shared tools, water buckets, hands, etc., on which bacteria can "hitch a ride" to the next victim). Seemingly well horses can harbor the bacteria, and when stressed, they can shed it or become ill. "The environment can be contaminated by birds, rodents, or other wild animals shedding the organism in feces, including contaminating feed for horses," says Simon Peek, DVM, MRCVS, PhD, Dipl. ACVIM, clinical assistant professor of large animal internal medicine, theriogenology, and infectious disease in the department of large animal internal medicine at the University of Wisconsin. *Salmonella* has received attention lately due to several outbreaks of nosocomial disease (infections picked up at a hospital by an animal that did not have that infection upon entrance) in various teaching hospitals.

Peek says there are more than 2,000 types of *Salmonella*, including several that affect horses. Most common is *S. typhimurium*, a type that also infects cattle and people. All types are zoonotic (affect animals and humans) except for one type that only infects humans.

"These Gram-negative bacteria cause a variety of problems--most commonly gastrointestinal disease and diarrhea," says Peek. "*Salmonella* can also cause abortion, but not as often in horses as cattle. The infection can cause septicemia; in foals it can cause generalized sepsis--bacteria in the blood spreading to multiple organs. In adult horses, bacteria are more likely to be confined to the GI tract, particularly the colon. It is much rarer in mature horses for bacteria to get out of the GI tract and into the bloodstream."

A foal with septicemia is dull and depressed, with high fever, and can die within 24 to 48 hours. Acute enteritis is the most common sign in adults, with fever and severe diarrhea. The watery diarrhea has a rotten smell and often contains mucus, and sometimes blood. Severe dehydration and toxemia occur; the animal can become very weak. *Salmonella* can also cause localized infections.

Shedders

"Some horses shed the organism without showing signs of disease; this is why it can become a problem at an equine hospital or referral institution," notes Peek. "A horse brought in for some other problem may be shedding bacteria in feces, perhaps intermittently."

Horses do not exhibit true carrier status, which occurs in cattle and some other animals, says Peek. He notes that certain types of *Salmonella* that affect species like cattle can cause an animal to be infected for life. "This does not happen in horses with the *Salmonella* types encountered in the U.S.," says Peek.

Most horses infected with *Salmonella* clear the organism from the body within days or weeks, or perhaps a few months, he notes. Yet some "silent but deadly" horses that shed the organism, but don't show any clinical signs. "They won't do that, however, for the rest of their lives," he notes.

"The sicker a horse becomes (with clinical illness), the more likely he'll be shedding the organism in large numbers," advises Peek. "If a horse is fairly healthy, he'll probably be shedding low numbers that might not be enough to cause clinical disease in another healthy horse. The problem in hospitals is that we are not dealing with healthy horses. In horses being treated with antibiotics, or that have an upset in the digestive system, or that had colic surgery, the dose of *Salmonella* bacteria necessary to cause clinical disease is a lot less."

The short version: If a horse's immune system is compromised when he is exposed to *Salmonella*, he is at higher risk.

"These horses may acquire the infection while in the hospital," says Peek. "There are also situations in which horses come down with clinical salmonellosis while in a hospital; they may have had the organism before they came in, but their immune system was strong enough to keep it at bay. Then they had colic surgery, or some other stressful procedure that allowed it to become a more rampant infection. Some hospitals and referral institutions take fecal samples for culture when a horse first comes in to identify horses with *Salmonella* organisms, and to protect themselves."

Hospitals sample incoming horses to find the ones shedding that could be a source of infection for other animals, and horses that are likely to get sick because they are harboring the organism in the intestines.

"Studies at teaching hospitals in the last decade show that the proportion of horses coming to equine hospitals that are shedding *Salmonella* in feces may be as high as one in 20," notes Peek. "In a busy hospital, that's a lot of horses; 5% of hospitalized horses appear normal, but may be shedding organisms even though they are there for a lameness, a throat surgery, or some other elective process."

This makes the problem much more complicated, and is one reason some hospitals culture horses as soon as they walk in the door, and intermittently during their stay.

Antibiotic Resistance

Peek says one concern that has recently surfaced in veterinary and human medicine is the number of *Salmonella* isolates that have developed multiple antibiotic resistance patterns, making them hard to treat with antibiotics. "This has raised considerable public health concerns about antibiotic use in livestock," he says.

"This has become quite controversial," Peek continues. "Our human medicine colleagues would prefer us to be extremely judicious about use of antibiotics for treating salmonella and other bacterial infections. The fear is that broad and indiscriminate use of antibiotics in animals will further promote resistance, making it more difficult to effectively treat human patients."

Spread of the Disease

Salmonella is feco-orally spread between animals by manure that contaminates feed or water. A foal might pick it up when nursing a mare or nuzzling her flank if she has lain on dirty bedding or her tail has flicked feces onto her body (if she's a shedder). A foal will also eat manure and can pick it up that way.

"Normal adult horses in a field rarely eat manure, but mares and foals often eat one another's feces," says Peek. "Thus, salmonella can be a bigger problem to control on a breeding farm. Breeders fear this disease because it can be a potentially lethal infection in foals, due to their naïve immune systems. It can get into the bloodstream and cause multiple organ failure."

Roberta Dwyer, DVM, MS, Dipl. ACVPM (epidemiology specialty) of the Gluck Equine Research Center at the University of Kentucky, says that when a farm has a salmonella outbreak, it's often little things that derail a good plan for containment. "One of the first things I ask at a farm is whether they have a rodent problem or if they feed on the ground. Mice droppings in hay or grain can be a significant source of *Salmonella*. Barn cats, bait, and traps are helpful, but if there's a serious mouse problem, you should contact professional rodent control people," she says.

Prevention

The best way a farm can protect against salmonella is to pay strict attention to cleanliness, prevent overcrowding, and limit possible exposure. "Getting rid of feces is important, along with isolation of animals that have diarrhea or are recovering from it," says Peek.

Dwyer says that if a horse develops diarrhea, isolate that animal immediately. "This means putting it in a stall or pen away from other horses until a diagnosis can be made or the diarrhea clears up," she says. "The exception is foal heat diarrhea, if you are sure that's what it is. Buy a box of latex gloves and wear a new pair every time you handle an animal or take its temperature."

Take care to not touch something another person might touch. "If you've been touching the sick horse and then go answer the phone, the phone is contaminated," Dwyer states. "Another person can get bacteria off the phone and go check capillary refill time on another horse, and salmonella is transmitted to that horse."

If you aren't careful about your feet, you may track bacteria (from watery feces on the ground or floor where you might not see it) to a clean area, potentially contaminating feed put on the ground or the hair coat of a horse that lies there. If that horse licks himself or a foal nuzzles a dam with a dirty flank, the disease is transmitted.

"People often move horses that were in contact with the sick one, taking them to different pens or pastures, but this is usually a big mistake," Dwyer advises. "They can be incubating the disease. There is an incubation time in which the organism is multiplying in the body, but the animal is still normal. If you move that exposed animal, you may put other horses at risk."

The ideal situation is to move the sick horse to a separate quarantine barn; only sick animals with the same disease go there, notes Dwyer. "Some big farms have a barn on the back 40 that is not used except for the occasional sick, contagious animal--and whoever takes care of the animal doesn't handle other horses," says Dwyer. After the animal is moved to the sick barn, the stall or pen it was in should be thoroughly cleaned and disinfected.

If a horse gets salmonellosis, other horses should be closely monitored. "If the one that came up positive is in a stall, get the other horses out of stalls, if possible," says Dwyer. "Even in some cases of undiagnosed foal diarrhea in Kentucky when we couldn't pinpoint the cause, we finally recommended all the mares foal outside."

If a farm has a high concentration of animals (and a lot of foot traffic, muck wagons, and hay/straw wagons going through the barn), this is a highly contaminated area in an outbreak. If other horses are currently healthy and have lived in the same pasture together, the safest place for them is on pasture, not in the barn, says Dwyer.

Keep groups together; don't mix horses that have not lived together. For a big group, put temporary fencing in the pasture they lived in, segregating them into smaller groups. If you've divided them and a horse is incubating the disease, he might potentially infect only three or four others instead of the whole herd, she explains.

"Horses should be grouped (in pasture or barn) according to age and use. All horses that go out for trail rides every weekend should be together, for instance, and not mixed with other horses," says Dwyer. "They should be in a separate pasture, away from the broodmares."

Peek is often asked how long an animal should be isolated or its feces disposed of uniquely. "Horses don't get infected with a species of *Salmonella* that stays there for life, but they may shed for several months," he says. "We can err on the side of caution and say six months, but most horses stop shedding within six to eight weeks."

Testing for Salmonella

You can culture and re-culture a horse to see when he stops shedding, but it won't be conclusive. You can't take a random fecal sample for culture, thinking you can give a horse a clean bill of health because that one is negative. Remember, shedding can be intermittent.

"In a hospital situation or when we're trying to prove a horse has salmonella, we take a sample every day for several days and may get one positive out of four or five attempts," says Peek. "This gets expensive and isn't always practical. It often doesn't get done on the farm, or after a horse goes home from the hospital. The client isn't going to culture every horse with diarrhea every day for several months--or wait a month and then do it every day."

Peek says PCR tests have been used to identify *Salmonella* DNA, but a PCR positive test does not mean the organism is alive, explains Peek. The test can identify DNA from dead organisms, which might mislead you into thinking the horse is still infective. "You might end up getting positives for a very long time."

Treatment

Antibiotics are controversial in treating salmonella, but are given to foals with documented or suspected infection because the organism more often will get beyond the GI tract and into the bloodstream.

"What's more controversial and a matter of clinician preference is whether adult horses with salmonellosis should receive antibiotics," says Peek. "If you ask 10 clinicians, there might be five who use antibiotics and five who do not. There are two things to consider. In an adult it's much less likely there will be whole bacteria in the blood (needing high levels of antibiotics to kill them, which is needed in foals). The other issue is the difficulty in giving a horse enough antibiotics systemically that the body will excrete enough of the drug into the colon to kill *Salmonella* organisms. You might think that by giving a drug orally (directly into the GI tract), you'd have a better chance of eradicating a *Salmonella* infection. But oral antibiotics may kill 'good' bacteria that ferment and digest feed. Sterilizing the gut is a bad thing in a horse."

He says on the plus side for giving antibiotics is the occasional case where whole bacteria get out of the bowel and into the blood of the adult horse. This is sometimes used as a justification for giving an antibiotic (and to kill actively replicating *Salmonella* within the GI tract, to lessen the damage to the gut), says Peek.

Primary treatment for a *Salmonella* infection is good supportive care and fluid therapy. "These horses get very dehydrated, with electrolyte and acid/base disturbances," Peek explains. "Fluid and electrolytes are crucial, along with colloids or plasma, if they need it. They lose a lot of protein through the inflamed colon. We also give strategic anti-inflammatory treatments."

Fluid is usually given intravenously to foals, and even to adult horses because the gut is often too compromised to absorb fluids given orally. "But high-volume fluid therapy in an adult horse becomes an economic issue; in any one day some of our worst cases might be given 100 liters of fluid or more," he says. "In a foal, it might be only five to 10 liters per day."

"With any cause of diarrhea, we are always fearful that the horse might develop laminitis," continues Peek. "It isn't as common in horses with salmonella as it is with Potomac horse fever, but any horse with acute diarrhea and colitis could founder," he explains. "We try to prevent this (with supportive footing and anti-inflammatory drugs such as Banamine) rather than having to treat this after the event," he explains. This type of gut infection produces endotoxemia, which always carries some risk for laminitis.

Take-Home Message

Salmonella bacteria can cause illness and even death in foals and adults. The disease is easily spread, and difficult to control and eradicate. However, good general hygiene and management techniques can help prevent problems in your horses.

FURTHER READING

Dwyer, Roberta. Lots of Elbow Grease for Disinfection Project. *The Horse*, November 1999, www.TheHorse.com/ViewArticle.aspx?id=387.

See the Salmonella category under Infectious Diseases at www.TheHorse.com.

REAL-WORLD RECOMMENDATIONS: Lessons from New Bolton Center

Biosecurity refers to all practices that reduce the chance that infectious diseases will be carried onto your farm by animals, people, or objects (such as vehicles, equipment, or feed). Biosecurity also includes practices that limit the spread of any infectious disease once it is present. Practitioners at the University of Pennsylvania's New Bolton Center in Kennett Square, Pa., have outlined several strategies to prevent infectious disease in your horse(s). Their knowledge comes not only from research and literature, but also from first-hand experience in confronting and eradicating a costly salmonellosis infection in the hospital last summer.

The cornerstone of any disease-prevention strategy is a good vaccination program. Careful management of your horse's housing and nutrition is also important, but you must consider the biosecurity of your facility. When considering how well you are protecting your animals from the risk of infectious disease, you must act on all of the following:

- Optimize housing; consider ventilation, cleanability of surfaces, and animal and human traffic patterns.
- Provide good nutrition to maintain health.
- Use antimicrobials judiciously and appropriately.
- Follow good basic hygiene and management practices. In addition to stalls and equipment, pay particular attention to the hand and foot hygiene of all personnel. Provide a place to wash hands.
- Ensure proper feed, manure, and water management; delivery of feed, water, and clean bedding; and removal of dirty bedding and manure. These procedures should be done in a manner that limits possible cross-contamination.
- Effectively choose and use cleaners and disinfectants.
- Identify animal and human traffic that represent the greatest risk to your farm and take steps to control it.
- Segregate high-risk groups such as broodmares and foals from:
 - High-traffic areas;
 - Sick animals;
 - Newly introduced animals; and
 - Animals that transiently visit your farm.
- Always use new sterile needles and syringes for all medications.
- Isolate and/or apply barrier precautions to sick animals.
- Know the source and medical history of any animals you purchase.
- Quarantine new arrivals.

If you take these steps and work with your veterinarian, you will minimize your risk of problems with salmonellosis.

Editor's Note: Information provided by New Bolton Center.

FOAL IMMUNITY

Foals don't get much protection from salmonella via colostrum, says Simon Peek, DVM, MRCVS, PhD, Dipl. ACVIM, clinical assistant professor of large animal internal medicine, theriogenology, and infectious disease in the department of large animal internal medicine at the University of Wisconsin. "The mare creates antibodies, but protection against salmonella is complicated—a combination of what's called humoral and cell mediated—and is not as straightforward as just antibodies that may be present in colostrum," he explained. "Salmonella is an organism that, when in a host, is within the cells. Antibody alone does not do a comprehensive job of getting rid of it. You need white blood cells to do their job, too. So, it's a bit different than some other infectious diseases where protection may be conferred more completely by antibodies contained in colostrum. The organism is similar to *Rhodococcus equi* in this respect. It tends to hide within the tissues of the intestinal tract, where it's very difficult for antibody to get to it."--*Heather Smith Thomas*

PREVENTING FURTHER INFECTION: Disinfecting After a Sick Horse

When a horse is diagnosed with salmonellosis, the first thing is to treat him, of course. But following very closely on the heels of that is preventing infection of other horses (and people) on the property. To the fullest extent possible, stalls, trailers, and equipment should be disinfected.

Stalls/Equipment--Roberta Dwyer, DVM, MS, Dipl. ACVPM (epidemiology specialty) of the Gluck Equine Research Center at the University of Kentucky says the worst cases are dirt floors and raw wood stalls.

"This is a challenging situation, because disinfectants safe to use around horses don't work on dirt," she says. "My recommendation, if it's not feasible to dig up the first eight to 12 inches of dirt, sand, or clay (to replace with new material after the outbreak) is to completely muck out the stall and let it dry completely. You can use fans on very low settings to help dry the floor. You don't want strong air movement or the bacteria may aerosolize (become airborne). Gentle air movement will hasten drying, as well as sprinkling barn lime on damp spots."

As far as walls and other surfaces go, cleaning before disinfecting is paramount; disinfectants don't work well in the presence of organic matter like dirt and feces. But pressure washing could be dangerous as any bacteria present could aerosolize; stick to hard scrubbing.

If a barn has raw wood stalls, Dwyer recommends cleaning with a disinfectant, then painting them with two coats of polyurethane or marine-quality varnish to seal the wood. "This is best to do in the summer when the stalls can be really dry," Dwyer advises. "You might have to do some caulking on knots and holes, but this will make a much easier surface to clean if you ever have to do it again."

"Any buckets or hay feeders in stalls also need to be cleaned with disinfectant, rinsed, then soaked in a disinfectant solution for 10 minutes," she adds. "Always rinse anything the horse eats or drinks out of with clean water several times and allow it to dry."

Trailer--A trailer might be the weak link in your defense plan, says Dwyer. If you haul a sick horse to a hospital, the trailer should be thoroughly cleaned and disinfected before hauling another horse. "Most people muck it out, but just cleaning out the manure is not enough. The inside should be scrubbed with detergent and rinsed. Then apply disinfectant and let it dry."

The shovel and fork used to clean out a trailer are also contaminated. These must be cleaned with a detergent, rinsed, and soaked in disinfectant for 10 minutes.

Pasture--It's almost impossible to "disinfect" a pasture where sick horses contaminate forage and ground. "That would adversely affect soil and grass, and raise environmental issues," says Dwyer. "Anything you could put in a pasture that would kill *Salmonella* in the soil would kill everything--all the beneficial micro-organisms." In one contamination situation, she recommended giving the pasture time to dry out, then chain harrowing the dry pasture to break up manure and expose more of it to sunlight and drying. She also recommended not putting horses on the pasture for two months.--*Heather Smith Thomas*

Editor's note: For more information on disinfection, see Hygiene/Disinfection under Facilities at www.TheHorse.com.

HYGIENE PROTECTS HORSES AND PEOPLE

If you are in the midst of an outbreak or dealing with any potentially contagious disease, there is great benefit in having hot and cold water available in the barn or tack room, and liquid soap in a pump dispenser for cleaning hands after caring for a horse. "Don't use bar soap; it becomes quite dirty after use," says Roberta Dwyer, DVM, MS, Dipl. ACVPM (epidemiology specialty) of the Gluck Equine Research Center at the University of Kentucky. "No one wants to touch it. Liquid pump soap is safer and need not be antibacterial. Regular soap is very effective for cleaning dirt off your hands. Use disposable paper towels for drying hands, so no one ever has to touch a towel someone else has used."

"Any of the hand disinfectant products are useful if they are 62-65% ethyl alcohol," continues Dwyer. "I also like the foams. These have been shown to work in human hospitals. You can use the gel or foam on clean hands (already washed), not these covered with manure or dirt. This not only protects the next horse you touch, but also yourself and other people you may contact."

"In most of the salmonella outbreaks in veterinary hospitals, people usually don't get sick because they are highly aware of the dangers and take precautions," notes Dwyer. "Do not allow children in a barn where there is a known salmonella case, and make sure your hands are clean before you go home to take care of children."

A sick horse in isolation should have limited contact with people. "The only people that should have access to that animal are the farm manager, horse owner, and essential workers," states Dwyer. "These people should be aware that salmonellosis can be transmitted to humans. Any individuals who are pregnant or immunocompromised due to cancer, immune diseases, or other issues are at risk of infection with a zoonotic disease."--*Heather Smith Thomas*

