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ANTHRAX

by Charles L. Stoltenow, DVM and Martin Hugh-Jones

EDITOR'S NOTE: *For many reasons Anthrax is an important disease for animals and humans occurring worldwide (except for a few mostly very cold areas). The fact that it is a Zoonotic Disease (one that affects both animals and humans and can spread from animals to humans) makes it one that we want to constantly be on the lookout for and keep our readers informed about. Anthrax is of considerable interest because while it occurs sporadically with long periods with no outbreaks, it then suddenly appears and quickly kills many animals and often affects humans as well. Our last article on Anthrax in this publication was prior to the development of the book on Zoonoses: Animal Diseases That Affect Man published by Christian Veterinary Mission in 2001. The feature article on Anthrax in this issue is an in-depth update on the disease and our first since 2001. It was developed and written by two well recognized authorities and we are greatly indebted to them for their assistance.*

Introduction

Anthrax occurs worldwide and is associated with sudden death. Anthrax can infect all warm-blooded animals, including humans.

The global distribution of anthrax is largely determined by soils with high calcium levels and a pH above 6.1, which foster spore survival. The anthrax organism (*Bacillus anthracis*) has the ability to form spores and become resistant to adverse conditions. Pasteurization or ordinary disinfectants may destroy vegetative anthrax organisms in animals or their secretions. However, if the animal carcass is opened and the organisms are exposed to air, they will form spores. Sporulated anthrax organisms are highly resistant to heat, cold, chemical disinfectants and drying but are not immortal. Survival of the spores can be lengthy, which is why soil contamination should be avoided and site disinfection carried out in an outbreak. However true long-term contamination is limited to a minority of livestock graves, especially those that collect water.

Herbivores – ruminants are most often affected, particularly cattle, bison and sheep - are susceptible to anthrax. Horses, swine and humans are less susceptible than cattle or sheep. Wild ruminants such as deer and elk also may become infected. Dogs and cats, can be infected usually by exposure to affected livestock and blood. Birds are not at risk because of their raised body temperatures. How-

ever outbreaks are seen in wild and commercial ostriches because they are cooler.

Definition

Anthrax is a non-contagious disease, known since ancient times but it became a matter of global public interest after the bioterrorist attacks in the U.S.A. during the autumn of 2001. Anthrax is caused by *Bacillus anthracis* which is a Gram-positive, encapsulated, spore forming, nonmotile rod. It is known by a number of names including malignant pustule, malignant carbuncle, malignant edema, wool-sorters' disease, charbon, Siberian ulcer, and ragpicker disease. Anthrax can be enzootic, persistent in an animal population, but usually occurring in only small numbers of cases. However with the right environmental triggers there will be animal epidemics.

There are three forms of anthrax infection: cutaneous, intestinal, and pulmonary.

World Distribution

Though worldwide it is now essentially absent from northern Europe, eastern USA & Canada and New Zealand. In Canada it is enzootic in specific locations in the North-West Territories (Slave River Flats) and Alberta (Wood Bison National Park), and has the potential if control is relaxed to form epidemics in the Canadian Prairie provinces, while in the U.S., the disease is a persistent endemic threat in eastern North and South Dakota and NW Minnesota, is enzootic in south-west Texas and suddenly 'appeared' in 2008 in SW Montana where it had been undetected for decades. In Australia, anthrax is sporadic, although a sudden and severe epidemic occurred in Northern Victoria in 1997. In Europe, the major enzootic areas are Greece, Spain, Turkey, Albania, southern France, and southern Italy.

While the incidence is generally falling worldwide it persists in certain countries; for example it is hyper-enzootic in Haiti and still enzootic in Bolivia, Mexico, and Peru where control programs have proven to be ineffective or non-existant. In contrast, vaccination programs in Belize, Nicaragua, and Chile have resulted in good control. It is still absent from the Guianas. In Russia and in countries of the former Soviet Union, lack of effective control programs is evidenced by the high percentage of human cases, reflecting the inadequacies of both the public health systems and the veterinary services. In Asia, anthrax is widespread in the Philippines, South Korea, eastern India, and in mountainous zones of western China and Mongolia; porcine anthrax is frequently reported in the highlands of Papua New Guinea. Africa remains severely afflicted, with major epidemic areas in wildlife areas such as Queen Elizabeth National Park (Uganda), Mago National Park Omo (Ethiopia), Selous National Reserve (Tanzania), Luangwa Valley (Zambia), Etosha National Park (Namibia), Kgalagadi Transfrontier Park (Botswana and South Africa), and Vaalbos and Kruger National Parks (South Africa). An anthrax-like disease has been found in wild non-human primates living in tropical rainforest, a habitat not previously known to harbour *B. anthracis*, and characterized by an unusually high number of sudden deaths observed over nine months in three communities of wild chimpanzees *(Pan troglodytes resus*) in the Tai National Park, Ivory Coast. However, *Bacillus* strains associated with this outbreak were toxigenic *B. cereus* and not typical *B. anthracis.*

Transmission

Outbreaks typically occur when livestock are grazing on neutral or slightly alkaline soil. Infection in animals usually is the result of grazing on infected pasture land. Animals usually exhibit the intestinal form of anthrax where the organisms mainly enter through the mouth, Following ingestion or inhalation, the organisms spread rapidly throughout the entire body. This systemic infection is lethal.

Flooding pastures with contaminated water or dumping infected carcasses in streams or ponds also may spread anthrax spores. Flooding readily contaminates low-lying ground or marshy areas, and resultant stagnant water holes may serve as a source of infection. Hay infested with spores may account for outbreaks of anthrax during the winter months.

The safest use of soil infected with the anthrax organism is to raise cultivated crops. Rusian experience indicates that sowing with a variety of crop plants – winter wheat, rye, maizwe, vetch, garlic, alfalfa, various grasses – is effective in making these sites safe for grazing, and even a single sowing of alfalfa with yard grass or vetch with oats.

Anthrax also may be spread through wounds that blood-sucking insects, dehorning or castration causes. Following rains and hatches of high numbers of haemophadic flies (e.g., horse flies) there is a real risk of epidemic spreading the disease outwards from normal sporadic cases in grazing livestock. Browsing stock (e.g., goats) are at risk from blow flies after feeding on infected carcasses and then vomiting excess fluids onto the leaves of nearby bushes and shrubs; they cannot digest their bloody meals if they cannot first eject the excess fluid in their stomachs. This results in these leaves being covered in spores.

Outbreaks have occurred because of contaminated commercial feed, particularly through bone meal, meat scraps, and other animal protein products.

For humans the source of infection is always infected animals, contaminated animal products, or environmental contamination by spores from these sources. Clinically these infections take the following forms:

Cutaneous anthrax can be contracted by inoculation during the process of skinning or butchering an animal or by contact with infected leather, pelts, wool, or fur. Products made from contaminated hair (e.g., shaving brushes), skins (e.g., drum heads) or bone meal (e.g., fertilizer) may continue to be sources of infection for many years.

Intestinal anthrax comes from the consumption of domestic and wild animals which were infected with anthrax spores. The acidic nature of gastric fluids are lethal for the vegetative cells. There is no evidence that anthrax is transmitted through the consumption of milk from infected animals.

Pulmonary anthrax comes from inhaling spores usually from contaminated wool or animal hair, but also from laboratory accidents and intentional nefarious activities associated with bioterrorism.

Cattle that died of anthrax.

Clinical signs in Animals

Clinical signs associated with anthrax depend to a certain degree on the species of animal involved and the route of infection. The incubation period is typically 3-7 days. When the anthrax organism enters the animal's body through the mouth or nostrils, the symptoms occur soon after infection (acute form) and death follows rapidly. When infection takes place through the skin because of injury or insect bites, in the initial stage it appears localized at the site of injury. The affected area initially is hot and swollen and becomes cold and insensitive. Later, the infection can become generalized.

Anthrax usually is a fatal disease with no prior signs observed. Upon or near death, blood may ooze from the body openings. While this can be marked it is in fact infrequent in occurrence This blood is heavily laden with anthrax organisms. The carcass has a marked bloating and decomposes rapidly.

If the infection is less acute, the animal may stagger, have difficulty breathing, tremble, collapse and die. In horses, colic may be observed. Edema and swelling may be seen over the body, particularly at the brisket and ventral parts of the body. Illness is observed for one or two days, but it may last five days; symptoms are preceded by fever, with a period of excitement in which the animal may charge anyone nearby. This is followed by depression in cattle or sheep. Death is sudden.

Sometimes the anthrax organism localizes itself in the throat area. The tongue, throat and neck are extremely swollen and a frothy blood-tinged discharge comes from the mouth.This is the typical form of anthrax observed in swine; occasionally it may occur in cattle and sheep.

Symptoms in Humans

The cutaneous or skin form occurs when anthrax spores invade a cut or abrasion, or from a contaminated horsefly bite. Initially, the site will itch, followed by swelling and discoloration of the affected area. Local pain usually is not present in spite of the marked swelling. If left untreated, cutaneous anthrax eventually can become septicemic and lead to death. Antibiotic therapy is very effective for the cutaneous form of anthrax. If untreated, cutaneous anthrax has a case-fatality rate approaching 20%. Photo A is a picture of cutaneous anthrax on the middle finger of a veterinarian who necropsied an infected heifer without using gloves. Photo B is a picture of cutaneous anthrax on the arm of a veterinarian who contracted the infection while working in the Rift Valley.

Photo A

The respiratory form of anthrax occurs when the spores are inhaled and then infect the lung tissue. Initial symptoms are mild and may resemble the flu or common cold, followed by fever and substernal pain On X-ray there is a

Photo B

typical mediastinal separation from local edema and fluid accumulation. The disease will progress at a rapid rate with shock developing within three to five days, followed by death. Once a systemic infection has developed, any therapy provides only limited success.

The intestinal form of anthrax occurs when spores are ingested, primarily through consuming contaminated meat. It is normally a very rare condition and almost always involves an explosive foodborne outbreak where many individuals are involved by exposure to a common source. These cases are usually reported from impoverished countries where people salvage dead or dying animals for human food and in the absence of effective rural veterinary services. Symptoms include fever, abdominal distress, shock and death.

Treatment

In animals, anthrax is highly fatal and treating affected animals is difficult. Response to treatment may vary; best results are obtained when drugs are administered early during an outbreak, especially to apparently healthy animals suspected of harboring an incubatory infection, i.e. in preclinical infections. Penicillin or tetracycline are the drugs of choice. A dose of 20 cc per injection site and a total of 40 cc per adult animal has been effective. When using antibiotics, vaccination with an anthrax vaccine should be delayed for five to eight days depending on antibiotic used. Anecdotal evidence indicates that vaccine induced immunity can develop in five days; more commonly deaths cease by eight days post-vaccination. The vaccine is a live spore vaccine and antibiotics may interfere with proper immunization of the animal as it will kill the vegetative organism as it emerges from the spore capsule. However, when faced with an outbreak situation, administering an antibiotic and a vaccine concurrently has been considered to be effective when significant germination occurs after the antibiotic titre in the blood has fallen away. The decision to use antibiotics in conjunction with vaccination must be made in consultation with the owner, their veterinary practitioner and regulatory authorities.

In humans, cutaneous anthrax is the most common form. Isolation is recommended to minimize possible spread via contact. Antibiotic therapy sterilizes a skin lesion within 24 hours, but the lesion progresses through its typical cycle of edema, ulceration, sloughing, and resolution. Penicillin is the drug of choice for cutaneous anthrax and is given for 5-7 days. Tetracyclines, erythromycin and chloramphenicol are also effective. The US military recommends parenteral ciprofloxacin or doxycycline for pulmonary anthrax; the duration of therapy is not well defined.

Diagnosis

If anthrax is suspected, do not perform a necropsy. The preferred biological sample for anthrax is a blood sample if it can be delivered promptly and chilled to the diagnostic laboratory; because of decomposition and acidification few blood samples will test positive after three days . Any samples should only be collected by a veterinarian. If whole blood is not available there are a few other samples that can be taken. They include a blood soaked cotton swab taken from blood-tinged fluids exuding from the anus, vulva, nostrils or mouth, and placed in a sterile, sealed tube; or exudate-contaminated soil placed in a sterile, sealed tube or plastic leak-proof container; or as a last resort a cotton swab soaked with fluid from the spleen if the animal has been eaten by predators or when a necropsy was performed. Letting these swabs dry encourages sporulation and kills off other organisms. Submission of solid tissues from organs is strongly discouraged unless no other sample is available. Isolation of the anthrax organism becomes very difficult if the animal has been dead for 48 hours or more. Saprophytic bacteria may overgrow *Bacillus anthracis*. Therefore, having a negative diagnosis from an animal that has died from anthrax is possible.

Differentials

Differentials include lightning strike, clostridial infection (e.g.,. blackleg, overeating), bloat, nitrate poisoning, cyanobacteria poisoning, bacillary hemoglobinuria, anaplasmosis and lead poisoning. In pigs, acute hog cholera, and African swine fever are diagnostic considerations.

Prevention

An effective vaccine is available (nonencapsulated, Sterne 34F2 strain). Since anthrax is a reportable disease in most areas, details on the use of the vaccine should be coordinated through the regulatory authorities. It is relatively safe and provides effective protection on most species of livestock. Anecdotal evidence indicates that immunity can develop in five days. It is usually protective by 8-10 days. It is recommended that a second “booster” vaccination two to three weeks after the first dose in heavily contaminated areas, and especially with horses. Vaccinated animals should not be slaughtered for 42 days after last dose of anthrax vaccine. There is no withdrawal time for milk.

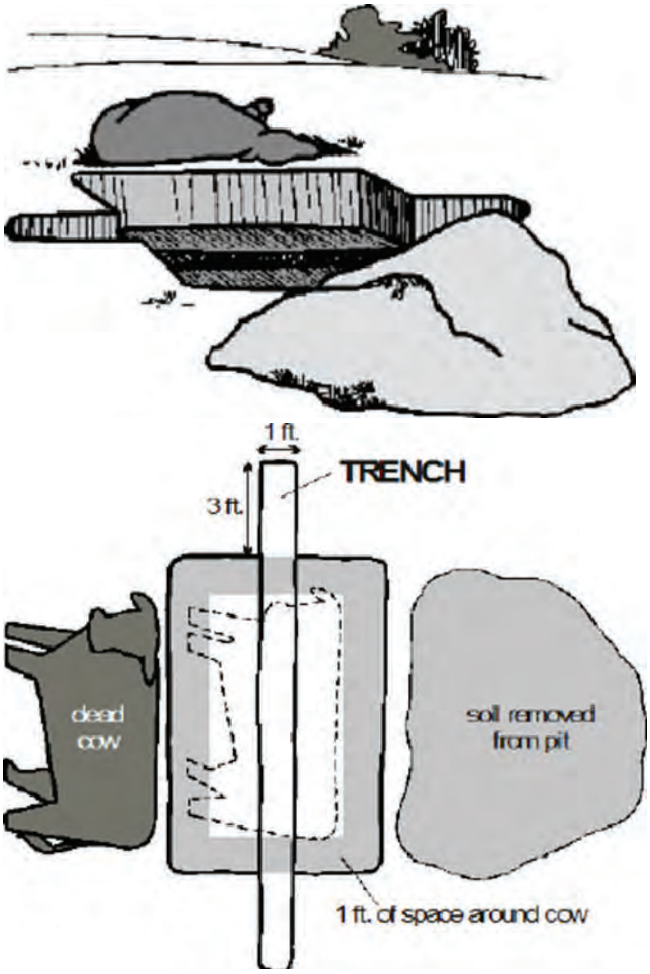

Figure A. Top view.

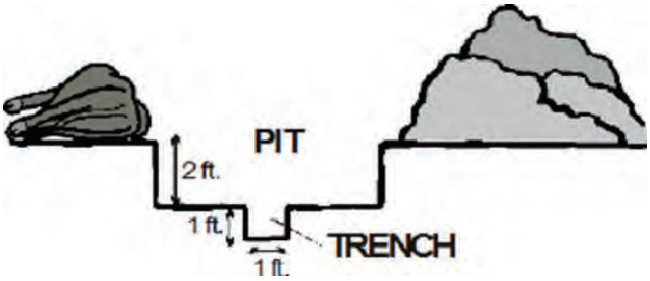

Figure B. Cross section of burning site.

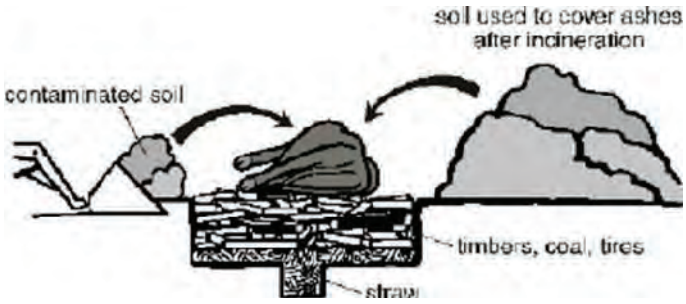

Figure C. Cross section of pit ready for burning.

Use caution when administering it to horses. Cases of *Clostridial* infections have been reported in horses at the injection site where the horses were vaccinated during a rainfall, or when the horses had wet hair coats. Local edematous reactions have also been reported in horses. Vaccinating horses in the brisket (pectorals) as an alternative helps minimize the potential of an adverse local reaction. Anecdotal evidence from the field indicates that dividing the dose in half and giving a half dose on each side of the neck may also help minimize local injection site reactions in horses. If the risk of an adverse reaction in a horse is greater than the risk of contracting anthrax, it may be wise to recommend that the horse(s) be confined to an area where they are fed off the ground or on concrete to decrease the probability of ingesting anthrax spores from contaminated soil.

All herds with a history of anthrax infection within the past 10 years and those herds within six miles (ten kilometers) of those herds should be vaccinated or revaccinated for the prevention of anthrax. All susceptible animals in these herds should be vaccinated. Susceptible animals include cattle, horses, mules, sheep, goats and pigs. Use of the vaccine should be considered for bison, and farmed elk and deer. Any use of the vaccine should be discussed with a veterinarian.

Outbreak Control

Livestock

All livestock in proximity to the affected animals should be treated with long acting antibiotics to stop any incubating infections. All others should be vaccinated. And move all these animals out of the meadow or pasture to limit further infections. Check them twice a day for the next ten days. Check temperatures by hand and any animal with as raised temperature should be immediately treated. All animals treated with antibiotics should be (re) vaccinated one week later.

Carcass Disposal & Site Disinfection

The carcass and all materials associated with the carcass should be destroyed and the ground should be disinfected. This can be very difficult. The preferred method of destruction is to burn the carcass. If incineration or cremation is not possible, burying the carcass deep (at least 6 feet) still is acceptable.

The following are general recommendations for burning a 1,000-pound carcass: Dig a pit about 2 feet deep and exceeding the length and breadth of the carcass by about 1 foot on each side (Figure A). Dig a trench 1 foot deep by 1 foot wide along the length of the center of the pit ex-

tending beyond the ends of the pit by about 3 feet; this serves as an air duct for the fire under the carcass (Figure B). Fill the trench and cover the bottom of the pit with straw and soak them with an accelerant (kerosene or diesel fuel) (Figure C). This trench under the carcasas is very important as it facilitates proper ventilation of the fire and speeds up the incineration. Whatever you do, get air and heat **under** the carcass -- by raising it up on green timbers or metal rods and bricks if necessary. Just stacking timber on top of the carcass will result in three days work to burn the carcass from the top down.

Cut heavy timbers such as railroad ties or pallets to fit across the trench and within the sides of the pit and place them on top of the straw. Add other pieces of wood (or coal) until the pit is filled to the level of the ground surface. Depending on the location of the carcasses and the environmental rules in place and only in extenuating circumstances, tires have been used in addition to or in place of wood (or coal). Saturate all of this with accelerant.

The carcass then can be lifted or drawn onto the pyre (combustible heap). Pour further accelerant over the carcass. Ignite the fire at either end of the trench. Once the incineration is well under way (probably after the first hour), cover the pyre with corrugated metal or other metal sheeting to retain heat but not lose ventilation.

If blood and body fluids have contaminated the ground and material under the animal, they should be incinerated as well. Remove soil deep enough to collect any blood and body fluids that have seeped into it. This could be up to 6 inches. This material can be placed on top of the carcass prior to igniting the pyre (Figure C).

The approximate quantities of fuel that will be needed are 100 pounds of straw, 2½ gallons of accelerant and 2 tons of wood or ½ ton of wood and ½ ton of coal. Anecdotal evidence would indicate that at least 18 automobile tires are needed for good incineration. Small deer, e.g., White Tails, will take two tires.

If soil and other related materials cannot be incinerated, it can be disinfected with 5 percent formaldehyde solution at 50 quarts per square yard.

After incineration, cover ashes and burnt contaminated soil with soil removed from pit.

If the animal cannot be burnt or buried or is just too large, such as an elephant, spray the carcass with 5% formaldehyde to discourage scavengers and densely cover it with thorn scrub. The objective is to delay scavengers for at least 5 days by which time the anaerobic decomposition will have acidified the carcass and killed the vegetative cells. Sporulation occurs in the presence of oxygen and decreasing nutrition. If the carcass is not opened there is minimal fluid spillage and exposure to air.

Personnel Protection

Personnel should take every precaution to avoid skin contact with the potentially contaminated carcass and soil. They should use protective, impermeable clothing and equipment such as rubber gloves, and rubber boots with no perforations. Do not expose any skin, especially that compromised with wounds or scratches. Disposable personal protective equipment is preferable, but if not available, wash any exposed equipment in hot water and detergent to achieve decontamination. Burn and bury disposable personal protective equipment with the carcass. And finally thoroughly wash your hands and face with soap.

To clean equipment used for digging the pit and moving the carcass, remove dirt, blood, hair and other materials with water (preferably hot) and detergent. Divert the wash water from the equipment into the pit for incineration. A diluted bleach solution (one part bleach to 10 parts water) can be sprayed on the clean equipment to further decrease the likelihood of anthrax being present. Allow this solution to remain on the equipment for three minutes. The risk of anthrax being spread via equipment used to dig the pit is unknown, but most likely is very small. The site where the animal died is not necessarily where the animal acquired the infection.

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All photos and graphics used in this article courtesy of the North Dakota State University.

UPDATES

EDITOR'S NOTE:

An earlier issue of International Animal Health News focused on An Overview of Vaccination in Farm Animals. It was one of our most discussed issues and we received many comments and requests for more information. It goes without saying that vaccination of farm animals is one of the most important methods we have to improve animal health and prevent disease. In areas where disease prevalence is very high, vaccination is critical to maintaining healthy livestock. Vaccine failure can result in severe distress for many who depend greatly on their animals. Following are two articles that discuss some of the myths associated with vaccination and a review of proper vaccine storage. It is often very difficult to keep vaccines at the proper temperature during storage and transportation, especially in rural areas. However, failure to keep vaccines at the proper temperature is one of the major problems related to vaccine failure. There is a great cost associated with livestock vaccination including vaccine cost, transportation, and labor. Don't let that expense in time and money go to waste by failing to handle the vaccine properly.

Exposing Nine Vaccine Myths

With so many cattle vaccines available — nearly 125 different vaccines are currently on the market — there is a considerable amount of information, and misinformation, out there. To help clear up some misconceptions, Vic Cortese, DVM, PhD, Dipl. ABVP, Pfizer Animal Health, busts nine common vaccine myths.

Myth No. 1: If a vaccine is licensed by the USDA, it will work all the time in all cattle.

False: The fact that a vaccine is licensed and available doesn't mean it always works.

There are many reasons why a vaccine might not work, including:

- It was used on the wrong age of animal.
- The wrong disease outcome was measured.
- It was used on the wrong species.
- The disease was overwhelming.
- Animals were already sick.

Myth No. 2: "Annual Vaccination" means a year of immunity.

False: We don't really know the duration of immunity. The USDA may not require duration of immunity studies. If a product successfully demonstrates efficacy at 14 to 35 days after the last vaccination they are automatically given annual revaccination labels. This does not necessarily mean the animal may be protected for 12 months.

Myth No. 3: The higher the antibody titer (level) after vaccination, the better the protection.

False: Titers may be a poor indicator of level of protection. There are many different antibodies involved in protection and non-protective antibodies can also be measured.

Myth No. 4: Vaccines are not effective in young calves because of blocking by maternal antibodies.

False: The role of maternal antibody interference is not clearly defined. Depending upon the disease, the type of vaccine, the pre-existing antibody levels and the route of administration, some vaccines may be blocked by maternal antibodies, but others are not.

Generally, viral vaccines are not inhibited by maternal antibodies. Two exceptions are bovine viral diarrhea (BVD) and parvovirus. And as a general rule, bacterins may be blocked by maternal antibodies. A noteworthy exception is *Lepto* hardjo-bovis.

Many vaccines for calves are not inhibited by maternal antibodies, so ask your vaccine supplier to see efficacy studies done in calves with maternal antibodies if it is a concern.

Myth No. 5: Rotation of vaccines gives more complete protection.

False: The descriptions surrounding vaccine rotation, such as "optimal antigenic diversity," "rotation means the broadest protection," "avoid vaccine inbreeding" and "antigenic diversity is the key," make it sound necessary.

The fact is, there are no challenge studies to support the

idea of vaccine rotation. It also disregards differences in vaccines and is solely focused on BVD vaccines. There is an impracticality of vaccine rotation because many animals are in different stages of vaccination at any given time.

Myth No. 6: Inactivated vaccines are safer than modified-live vaccines.

False: The truth is, killed vaccines may cause more adverse reactions in animals because they contain more antigen mass, consist of more biologic components and rely on adjuvants.

Myth No 7: BVDV congenital infection protection is more important than persistent infection protection.

False: Persistently Infected (PI) animals are what we must prevent to control BVD. The true definition of congenital infection is exposure of the fetus in a non-immune pregnant cow during any stage of pregnancy. But it is often used to define exposure during the third trimester. This causes calves to be born with self-made BVD antibodies. The impact of later-term exposure on the health of newborn calves is not clear.

Myth No. 8: The timing of scours vaccines in the cow is not important.

False: The timing of the dam's scours vaccination is critical to get maximum protection for the calf, and is crucial to good colostrum management.

The best time to vaccinate for scours is three to four weeks prior to calving. This timing will help ensure the maximum number of colostral antibodies are transferred to the calf through the colostrum, because peak immunity levels occur at this time.

Myth No. 9: Intranasal vaccines provide superior protection in cattle.

False: Intranasals may provide similar protective capabilities as systemic vaccination. Intranasal vaccination may be used for calves:

- Whose immune systems have already been compromised.
- That are heavily stressed.
- That are in the face of disease outbreaks.

As a result, safety of their use is critical because it usually comes at a time when disease outbreaks are anticipated in young animals that are already heavily stressed.

Originally published in Bovine Veterinarian, October 2009. Used with permission.

Storing Vaccines Properly

Refrigeration is required for most animal health products (antibiotics, pharmaceuticals, vaccines, etc.). Vaccines should be kept under refrigeration between 2° to 7° C unless the product is labeled for a different storage temperature. Storing products at less than 2° C can damage the product because the antigen can separate from the adjuvant. Many producers are good at storing animal health products in the refrigerator. However, many of these refrigerators are older models and may not be functioning properly. In addition, the location of the refrigerator (outdoors, in a barn, dusty or wet environment) can affect its ability to function properly.

In order to determine if animal health products were being stored at the proper temperature, a Watchdog data logger was used to monitor and record the refrigerator temperature every 10 minutes for 48 hours. Results from this demonstration clearly showed temperature of refrigerators should be monitored very carefully. In addition, following a simple refrigerator maintenance plan can help ensure the refrigerator is working properly.

Refrigerator Demonstration Results

Watchdog data loggers were used to record the temperature at 10-minute intervals for 48 hours in 180 refrigerators. There were a variety of refrigerator types tested including freezer-on-top, side-by-side, and mini refrigerators. Forty-three percent of the refrigerators were over 11 years old. The refrigerators were located in a variety of locations (kitchen, barn, office, workshop, and garage).

Of the 5,016 animal health products stored in the test refrigerators, 4% were expired and 10% were opened. For most products, an expiration date is printed on the label. Any expired animal health product should not be used and should be disposed of properly. Review the manufacturers' insert for proper disposal methods or unique disposal concerns regarding human health.

Mixed modified live vaccines should be disposed of 1 hour after mixing. Killed vaccines should be disposed of approximately 10 days after opening.

Of the 180 refrigerators tested, only 49 (27%) recorded temperatures within 2° to 7° C more than 95% of the time during the 48 hour test period. In contrast, forty five refrigerators (25%) recorded temperatures within 2° to 7° C

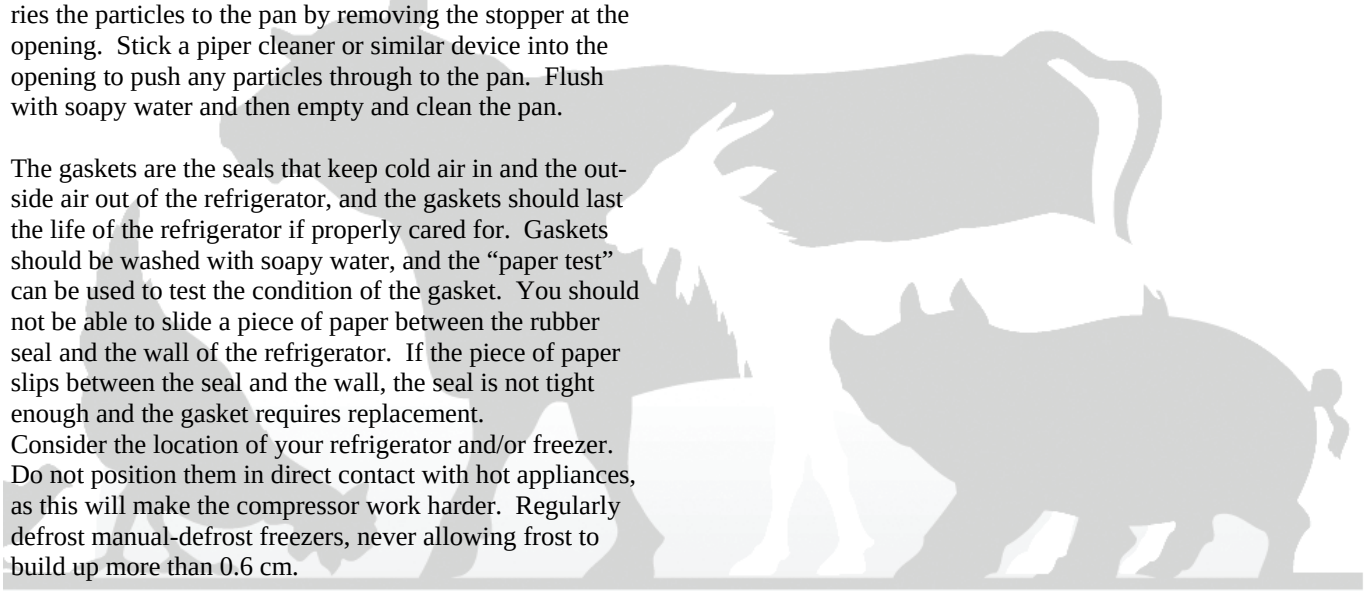
less than 5% of the time over 48 hours. It is recommended that animal health products should be stored in refrigerators that maintain the temperature within 2° to 7° C 95% of the time. **Given this recommendation, 73% of the refrigerators tested are unacceptable for storing animal health products.**

General Refrigerator Maintenance

All refrigerators require general maintenance and it is important to keep the refrigerator coils clean. Refrigerator coils are located in the rear of the refrigerator and can be cleaned by vacuuming the vents and coils. Dusty coils have to work harder to cool down the interior and contents of the refrigerator.

The drip pan, located beneath the refrigerator, should also be cleaned. In automatic defrost models, the water from the defrost process flows out a drain in the floor of the refrigerator and into a pan where it sits until evaporating. Food particles can be carried along and clog the drain or be left behind to rot. You can clear out the tube that carries the particles to the pan by removing the stopper at the opening. Stick a piper cleaner or similar device into the opening to push any particles through to the pan. Flush with soapy water and then empty and clean the pan.

The gaskets are the seals that keep cold air in and the outside air out of the refrigerator, and the gaskets should last the life of the refrigerator if properly cared for. Gaskets should be washed with soapy water, and the "paper test" can be used to test the condition of the gasket. You should not be able to slide a piece of paper between the rubber seal and the wall of the refrigerator. If the piece of paper slips between the seal and the wall, the seal is not tight enough and the gasket requires replacement.
Consider the location of your refrigerator and/or freezer. Do not position them in direct contact with hot appliances, as this will make the compressor work harder. Regularly defrost manual-defrost freezers, never allowing frost to build up more than 0.6 cm.



Summary

This demonstration assisted producers in determining if they are storing animal health products according to labeled instructions. When animal health products are stored incorrectly, the effectiveness of the product may become compromised. All animal health products that are past their expiration date or opened should be disposed of properly.

Adapted from "BQA: Storing Vaccines Properly," a University of Arkansas Cooperative Extension Service publication, by Dr. Tom R. Troxel, Professor and Associate Department Head-Animal Science.

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