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# Knowledge

## *Clostridium perfringens* Type A: disease fundamentals and prevention strategies


**SUMMARY**

*Clostridium perfringens* Type A is an emerging economic concern for dairy and beef producers because of its association with serious and often deadly gastrointestinal diseases in both cows and calves. This bacteria is associated with hemorrhagic bowel syndrome (HBS) in mature cows, which strikes apparently healthy animals without much warning and has a case fatality rate of 85 percent or higher. *Clostridium perfringens* Type A also is associated with abomasal ulcers, abomasal hemorrhage and abdominal tympany in calves, which are frequently fatal. Individual cows or calves can be affected by these disorders, but frequently a group of several cases occurs within a single herd or geographic region. The reported number of HBS cases from 1996 to 2002 increased dramatically, supporting opinions that this is an emerging disease. Any herd is at risk, but in the case of HBS, it more frequently affects larger, more productive dairy herds located in the Western region of the United States.

Because treatment measures often are unsuccessful, prevention and management strategies are the best line of attack against the disease. **Clostridium Perfringens Type A Toxoid** from Novartis Animal Health is the first cattle vaccine for this disease to receive a conditional license by the USDA. The vaccine can be given to pregnant or non-pregnant animals to aid in the control of disease syndromes caused by the alpha toxin of *C. perfringens*.


Clostridial organisms are commonly found in the environment and are part of the normal intestinal microflora of cattle.[1] However, dietary changes or parasitism may produce a favorable growth environment for these organisms, resulting in production of potent toxins that are harmful to the animal.

There are five types of *C. perfringens* (A, B, C, D and E), which are identified by the main types of toxins they produce (alpha, beta, iota, epsilon and theta). *Clostridium perfringens* Type A is identified as producing only alpha toxin out of the group of major toxins. Other toxins (beta 2 and enterotoxin) can be found in some isolates of *C. perfringens* Type A, but their role in disease is not known at this time. *Clostridium perfringens* Type A and its alpha toxin are associated with serious gastrointestinal diseases in both young and mature animals.

Because treatment success is rare, emphasis is placed on preventative measures, such as vaccinating the pregnant cow to provide her with active immunity and provide her offspring passive immunity via colostrum.[2]

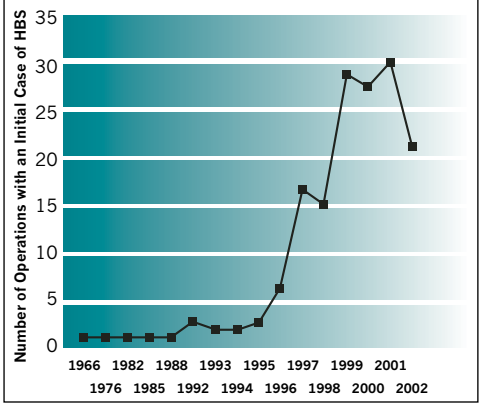
Until recently, there was not a commercial vaccine approved for *Clostridium perfringens* Type A, so producers relied on custom, or autogenous, vaccines to battle this clostridial strain. But now Novartis Animal Health has introduced **Clostridium Perfringens Type A Toxoid**, a conditionally licensed vaccine that gives veterinarians and producers a new tool in the battle against diseases associated with *C. perfringens* Type A.

### *C. perfringens* Type A and mature cows

Hemorrhagic bowel syndrome (HBS), also known as jejunal hemorrhage syndrome or bloody gut, is a frustrating disease that strikes apparently healthy cattle without warning. HBS is more prevalent in dairy cows, especially in early lactation, although it also has been reported in beef cattle.[3]

HBS results in a case fatality rate of 85 percent or higher, typically within 24 to 36 hours after onset of symptoms. According to NAHMS, from 1996 to 2002, the number of operations reporting their initial case of HBS increased dramatically, supporting opinions that this is an emerging disease.[4] (See Figure 1.)

**Figure 1. Operations Reporting Their Initial Case of HBS**




Even though HBS is increasing, producer awareness is relatively low. A 2003 NAHMS survey of producers in 21 states showed that only 1 percent felt they were knowledgeable about the disease. More than 87 percent had never heard of it. Clearly, education is needed to help producers understand and deal with HBS.

## Risk factors

In the last few years, several studies have indicated an association between HBS and *C. perfringens* Type A. While no single cause has been identified for HBS, *C. perfringens* is believed to be a contributor as it is commonly isolated from the gastrointestinal tracts of afflicted animals, while other enteric pathogens like *Salmonella* spp. and bovine viral diarrhea virus are rarely present in HBS cases.

Researchers have isolated *C. perfringens* Type A in both fecal cultures and blood clots in the jejunum of affected cows. A retrospective study from Colorado State University found that *C. perfringens* was isolated in 17 of 20 fecal samples and five of five intestinal biopsy specimens from cases of HBS.[5]

In addition to *C. perfringens* Type A, HBS is linked with early lactation rations that are rich in energy and protein and low in fiber. Mold also has been implicated in the disease, specifically *Aspergillus fumigatus* found in livestock feeds.

HBS can be found in any size herd in any location. However, USDA reports that it occurs most frequently in:

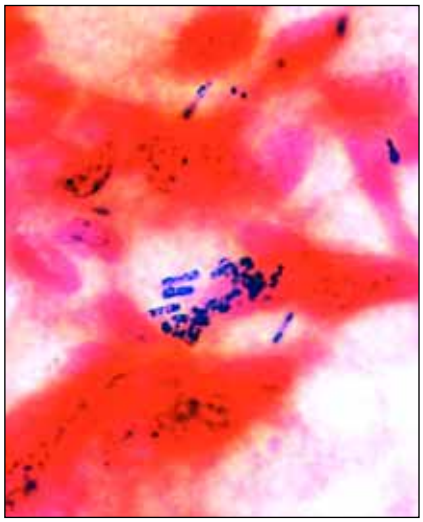
- Operations with 500+ cows
- More productive herds with rolling herd averages of 20,000 lbs. or greater
- Operations located in the Western region of the United States

Individual animals may be affected, but frequently a cluster of several cases appears within a single herd or geographic region.

## Signs of HBS

HBS begins with a sudden and sometimes massive hemorrhage into the small intestine, resulting in blood clots that obstruct the intestine. Although affected cows are often found dead or dying with no warning signs, following are some of the clinical symptoms of HBS:

- Sudden and complete anorexia
- Rapid pulse and respiratory rate
- Pale mucous membranes
- Severe decrease in milk production
- Severe depression
- Dark, tar-like feces, often containing clots of digested blood



**Rod-shaped clostridial cells are apparent in the gram stain from the abomasal contents of a calf with a distended abomasum due to clostridial abomasitis. Fluid from a healthy calf would normally have very few bacteria and no clostridia present.**

- Abdominal distention, especially in lower right abdomen
- Normal or below-normal rectal temperature
- Scattered, low pitched "pings" in lower right abdomen

The jejunum is the primary site of pathology, with findings including bloody fluid or clots

**Ultrasound image of an HBS intestinal lesion.**

**Abdominal distention, especially in the lower right abdomen, is a symptom of HBS. When the animal is standing, the abdominal contour appears round or pear shaped.**

in the lumen of the gut and a significant portion of the gut, up to three to four feet, affected.

Treatment of cattle with symptoms of HBS is rarely successful. Cattle may occasionally recover after treatment with fluids, laxatives, anti-inflammatory drugs and antibiotics, but more often, the disease progresses to ileus, intestinal necrosis, peritonitis and shock. Surgical treatment also leads to complications of recurrent clotting and intestinal obstruction.

## Prevention is best course

With a case fatality rate of 85 percent or higher, prevention must be the focus for HBS. In the past, prevention options have included the use of a custom or autogenous vaccine for *C. perfringens* Type A. Many veterinarians report favorable results from custom vaccines manufactured by Novartis Animal Health.

In addition to vaccination, other management measures to consider are:

- Evaluating and correcting nutritional factors that may predispose cows to HBS, such as lack of roughage or too much carbohydrate in the diet
- Testing silage to verify proper ensiling, quality and to check for the presence of *C. perfringens* Type A, mold or mycotoxins
- Practicing good bunk management, such as keeping feed pushed up and removing leftover feed from the bunk daily
- Identifying and correcting problems that might lower disease resistance during transition and early lactation

To minimize the impact of *C. perfringens* Type A, producers should work with their veterinarian to determine the best vaccination and management protocols for their herds.

**Prevention strategies are the best option for managing HBS. In addition to vaccination, there are nutritional management factors that can be employed.**

## *C. perfringens* Type A and calves

*C. perfringens* Type A also can be deadly for young beef and dairy calves. In calves, *C. perfringens* Type A is associated with abomasal ulcers, abomasal hemorrhage and abdominal tympany. These calves show signs of quick onset of abdominal distension with pain, bloat, depression, feed refusal and sudden death. While there can be more than one cause for this syndrome, researchers have isolated *C. perfringens* Type A from affected calves in several studies.[2]

For example, *C. perfringens* Type A was isolated from seven of eight neonatal calves that were referred to Kansas State University for clinical examination or necropsy. These animals – a mix of dairy and beef calves two to 21 days old – showed acute onset of abdominal tympany, colic, depression or death. Researchers concluded "the acute abdominal syndrome in the neonatal calves was unrelated to copper deficiency, and that C. *perfringens*, particularly Type A, may have had an appreciable contributory role in its pathogenesis."[6]

In another study, intraruminal inoculation of *C. perfringens* Type A into healthy calves, four to 12 days old, induced anorexia, depression, bloat, diarrhea and in some cases, death.[7]

Standard clostridial seven-way vaccines do not protect against Type A, and until now, no commercial vaccines for *C. perfringens* Type A have

***Clostridium perfringens* Type A can cause sudden death in young beef and dairy calves.**

been available. However, Novartis has produced custom, or autogenous, vaccines for *C. perfringens* Type A, and practitioners have been successful using them in herds where Type A has been isolated in calves.

## *C. perfringens* Type A vaccination

Novartis Animal Health has been on the forefront of the *C. perfringens* Type A issue, conducting research and producing custom vaccines since the 1990s. After more than a decade of work, Novartis is pleased to introduce the first USDA conditionally licensed **Clostridium Perfringens Type A Toxoid** for cattle.

To receive a conditional license, the vaccine was tested using a USDA protocol and standardized test, which requires a reasonable expectation of efficacy to be demonstrated by the development of a serum antibody concentration of at least four international antitoxin units per mL in at least 80 percent of vaccinated animals that were seronegative prior to vaccination.

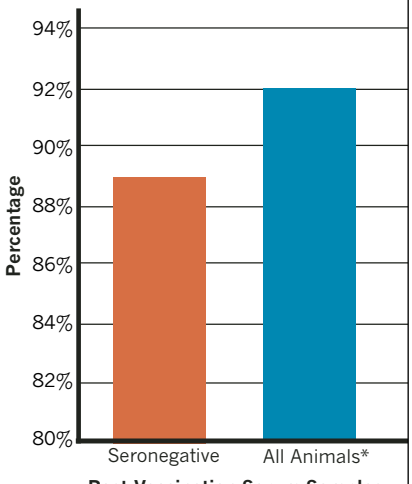
The vaccine was tested using a study involving 13 vaccinates and four non-vaccinated controls. Vaccinates received two 2-mL SubQ doses of **Clostridium Perfringens Type A Toxoid** three weeks apart. Results showed that using the vaccine surpassed USDA requirements, with eight international antitoxin units per mL being achieved in 89 percent of the vaccinated animals that were seronegative prior to vaccination. When including calves with pre-vaccination titers, the seroconversion rate was 92 percent.[8] (See Figure 2.)

Field studies involving 867 dairy and beef cattle – both open and pregnant – of various ages and breeds demonstrated the product is safe when used according to label directions.[9]

**Clostridium Perfringens Type A Toxoid** is labeled for use in healthy cattle as an aid in the control of disease syndromes caused by the alpha toxin of *C. perfringens*. It contains a proprietary dual-component adjuvant system for optimum immune response and low tissue impact.

Two mL of the vaccine should be administered subcutaneously in the neck, with revaccination in two to four weeks following initial dose. Calves vaccinated prior to five months of age should be revaccinated at five to six months of age. Revaccinate annually or as recommended by your veterinarian. The product can be given to pregnant or non-pregnant animals, and can be given to calves as young as one month of age.

**Figure 2. Percentage of Animals Reaching Minimum Requirements**





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*Photos courtesy of Drs. Robert Callan and David Van Metre, College of Veterinary Medicine and Biomedical Sciences, Colorado State University.*

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