



Knowledge

***Clostridium perfringens* Type A in swine – exploring a challenging disease**

SUMMARY

Even though *Clostridium perfringens* Type A naturally resides in the swine intestine, it is one of the leading causes of diarrhea in neonatal pigs. Pathogenic Type A bacteria produce destructive exotoxins, which cause yellow-to-white pasty diarrhea – usually

within the first week of life. Mortality typically is low, but the impacts on performance are seen throughout the pig’s lifetime.

Karen Post, DVM, MS, veterinary bacteriologist at the Rollins Animal Disease Laboratory in Raleigh, N.C., says that 35 percent of pigs with diarrhea that

were less than one week of age tested positive for *C. perfringens* Type A in a recent study performed at the laboratory.¹

Clostridium Perfringens Type A Toxoid from Novartis Animal Health US, Inc. is the first swine vaccine for this disease to receive a conditional license by the USDA.

Diarrhea plays a major role in reduced weaning weights, which is the first critical point of measuring a pig’s growth ability from the nursery through the finishing stage. One of the leading causes of diarrhea or enteric diseases in neonatal pigs is *Clostridium perfringens* Type A.²

C. perfringens Type A is a Gram-positive, spore-forming, rod-shaped bacterium that occurs naturally in the swine intestine. It is widely distributed in the environment and can be found in soil and areas susceptible to fecal contamination.

To demonstrate its prevalence in pigs, Karen Post, DVM, MS, veterinary bacteriologist at the Rollins Animal Disease Laboratory in Raleigh, N.C., summarized neonatal pig

diarrhea submissions from 1998 to 2000. Her survey showed that in pigs less than one week of age, 35 percent of neonatal enteritis cases were attributed to *C. perfringens* Type A.¹

C. perfringens is categorized into five types based on the production of four major toxins – alpha, beta, epsilon and iota. As Table 1 shows, all isolates of *C. perfringens* produce alpha toxin, but not all produce the levels of toxin needed to cause disease. Strain-to-strain variation in the quantity of alpha toxin produced allow for some isolates to be virulent while others are harmless. Minor structural differences in alpha toxin also may contribute to virulence by allowing for accumulation of the toxin in the gut.³



***C. perfringens* Type A is one of the leading causes of diarrhea or enteric diseases in neonatal pigs.**

Type	Alpha	Beta	Epsilon	Iota
A	X			
B	X	X	X	
C	X	X		
D	X		X	
E	X			X

Another factor that may be connected with *C. perfringens* Type A diarrhea is beta2 toxin. This toxin, along with other variations in the Type A strain, may be associated with syndromes that cause sporadic disease in the barn.³ More than 90 percent of strains isolated from porcine neonatal enteritis are positive for beta2.⁴

Control of *C. perfringens* Type A is becoming increasingly important to offset the poor performance of pigs affected by diarrhea. Infection by *C. perfringens* Type A is estimated to cause substantially more than 10 percent loss in neonatal productivity.⁵ According to Tim Loula, DVM, Swine Vet Center in St. Peter, Minn., scouring pigs gain 0.5 lbs. per

day less than they typically would if they weren't sick.² So if a piglet has scours for three days, or for 15 percent of its time on the sow, they do not gain the 1.5 lbs. their littermates would. Piglets may even lose weight. Loula says that a scours event always leads to lower weaning weights, which correlates directly with survival in the nursery and grow/finish phase. Lower weaning weights correlate to lower average daily gain as well. Labor costs also increase during a scours event because of the time needed to treat infected pigs.

There are numerous ways to help control *C. perfringens* Type A disease syndromes, including management methods and custom vaccines; however, the unpredictable nature of the bacteria makes it challenging. Now Novartis Animal Health has introduced **Clostridium Perfringens Type A Toxoid**, a swine vaccine with a USDA-issued conditional license that gives veterinarians and producers a new tool to battle diarrhea associated with *C. perfringens* Type A.

Evidence of disease

C. perfringens Type A disease develops during the first week of life and sows are the likely source of infection⁴ through fecal contamination. Clinical signs include creamy or pasty diarrhea. It lasts about five days, and feces



In piglets where enteritis is induced by *C. perfringens* Type A, the intestinal mucosa is covered with fibrinonecrotic debris. Photo courtesy of Dr. C. Perfumo, La Plata University, Argentina, and the American Association of Veterinary Laboratory Diagnosticians.

may become pink and filled with mucus.⁶ Mortality rate is low, but there is an impact on weaning and finishing weights because of setbacks with illness. Because piglets' immune systems are not fully developed, there is a possibility of co-infection with rotavirus, *E. coli* or *C. difficile*.

At necropsy, the small intestine is flaccid, thin-walled and gas-filled with watery contents and no blood. Mucosal inflammation is mild, rarely with adherent necrotic material. The large intestine may be distended with yellowish, pasty content without lesions.⁶ It often takes the form of mild necrotizing enterocolitis with villus tip damage, affecting primarily the jejunum and ileum.⁷



Clinical signs of *C. perfringens* Type A disease include creamy or pasty diarrhea. Signs develop during the first week of life and last about five days. Photo courtesy of Tim Loula, DVM, Swine Vet Center in St. Peter, Minn.

Managing *C. perfringens* Type A

Environmental factors, including a drafty room or a change in the season, may trigger Type A infections. In addition to vaccination, good pre-farrowing and neonatal management are critical in keeping infection at bay.

Pre-farrowing preparation:

- **Pressure wash, clean and disinfect farrowing room.** Sanitizing the farrowing room before sows arrive helps reduce the number of organisms in the environment. However, pathogens from inside the sow may enter the room when she does.
- **Set temperature and ventilation systems for young pigs.** Warm temperatures with low ventilation speeds keep pigs comfortable. Drafts are a factor in diarrhea outbreaks.
- **At the time of farrowing, remove all sow manure in crate.** This removes the chance for piglets to come in contact with *C. perfringens* Type A.

Day one care:

- **Check for chilled piglets.** Keeping pigs warm and dry with heat lamps after birth provides them with energy needed to nurse.
- **Piglets *must* receive adequate colostrum.** Colostrum is needed within the first few hours after birth to provide passive immunity for the piglet. There is a short window of time where the gut lining allows antibodies and cells to pass through to the bloodstream. See Figure 1. High levels of antibodies are passively transferred to the piglet, providing it with a defense mechanism to fight bacteria, viruses and toxins.
- **Split suckling may need to be incorporated.** Split suckling ensures that weaker pigs have access to colostrum by eliminating competition from stronger pigs for a few hours.

When disease occurs, it is important to identify the pathogenic isolates by conducting postmortem evaluations. An accurate diagnosis is needed to distinguish between *C. difficile* and *C. perfringens* Type A because both cause similar signs of diarrhea.



Colostrum within the first few hours after birth is essential for piglets to build a healthy immune system by obtaining antibodies through passive transfer from the sow.

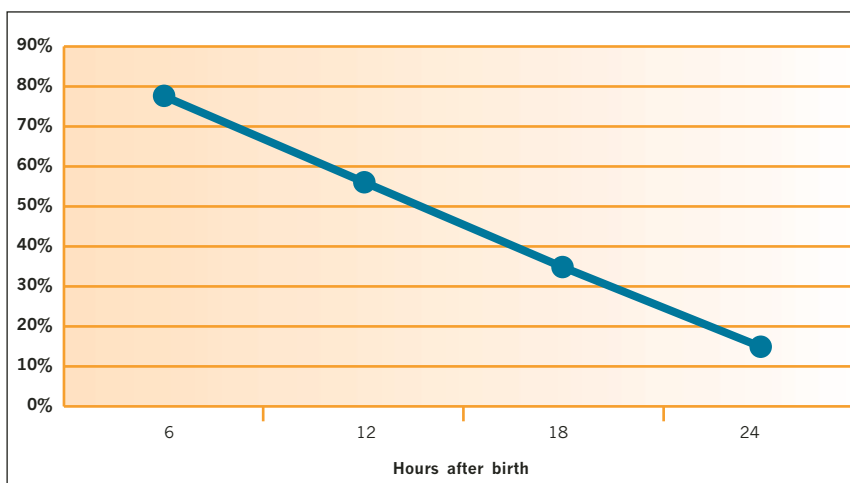
Controlling *C. perfringens* Type A

C. perfringens Type A diarrhea can be sporadic with varying severity. Other management tools, such as feedback, where piglet diarrhea is fed to sows or gilts pre-farrow to expose them to the pathogenic organisms, have been utilized to control these cases of diarrhea. Antibiotics in pre-farrowing and lactation feed, or piglet antibiotics on day one (injectable or oral) have also been used to treat the problem with limited success.

In some cases, *C. perfringens* Type C toxoids have been used for cross protection against *C. perfringens* Type A. Even though *C. perfringens* Type C strains may produce alpha toxin, Glenn Songer, PhD, Department of Veterinary Science and Microbiology, University of Arizona, says that in his laboratory tests of several commercial type C vaccines, no antitoxin responses to alpha toxin were found.⁹

Until recently, commercial vaccines for Type A were not available because they are

Figure 1.⁸ Levels of antibody available to piglets by nursing decrease over the specified time period, as colostrum becomes milk.



complicated to develop and manufacture. Producing and inactivating the alpha toxin in sufficient quantities to satisfy vaccine efficacy requirements is challenging. The toxin concentration changes throughout the growth cycle, and proteases and other enzymes easily destroy it. Plus, not all strains of *C. perfringens* Type A are equal in toxin production capability.

Novartis Animal Health has been on the forefront of the *C. perfringens* Type A disease emergence, conducting research and producing custom vaccines since the 1990s. Novartis is pleased to introduce the first USDA conditionally licensed **Clostridium Perfringens Type A Toxoid** for swine. Novartis scientists have developed a way to produce a Type A vaccine with consistent toxoid levels that meet the efficacy standards for this product.

To receive a conditional license, the vaccine was tested following USDA guidance documents.¹⁰ Data supporting the vaccine was reviewed and accepted by USDA to provide reasonable expectation of efficacy and potency. Efficacy of the vaccine is demonstrated by the development of a serum antibody concentration of at least four international units per mL in at least 80 percent of vaccinated animals that were seronegative prior to vaccination.



Control of *C. perfringens* Type A is becoming increasingly important to offset the poor performance of pigs affected by diarrhea. Clostridium Perfringens Type A Toxoid gives veterinarians and producers a new tool to battle diarrhea associated with *C. perfringens* Type A.

The Novartis vaccine was tested using 35 pigs 10 weeks of age with no history of clostridial enteric disease. Five pigs served as the non-vaccinated controls, while the remaining vaccinates received two, 2-mL doses of **Clostridium Perfringens Type A Toxoid** three weeks apart.

A proprietary dual-component adjuvant formulation plays an important role in the effectiveness of this vaccine.

Field studies involving 1,364 bred gilts or sows and 590 feeder

pigs demonstrated the product is safe when used according to label directions.¹¹

Clostridium Perfringens Type A Toxoid is labeled for use in healthy swine as an aid in the control of disease syndromes caused by the alpha toxin of *C. perfringens*.

Two mL of the vaccine should be administered intramuscularly, with revaccination in two to four weeks. Revaccinate as recommended by your veterinarian.

1. Personal communication with Karen Post, DVM. May 3, 2006.
2. Personal communication with Tim Loula, DVM. May 8, 2006.
3. Songer JG. Clostridia infections in swine: the best of microbial imperialism. ISU Swine Disease Conference for Swine Practitioners. 2002.
4. Songer JG, Uzal FA. Clostridial enteric infections in pigs. *J Vet Diagn Invest*. 2005;17:528-536.
5. Songer JG, Glock RD, Post KW. Clostridial diarrheal diseases: neonatal infections that affect

- postweaning performance. *American Association of Swine Veterinarians*. 2004;491-494.
6. Bosworth B, Hammer JM, Walz M. Control of porcine enteritis associated with Clostridium perfringens Type A: Is alpha toxoid the solution? *American Association of Swine Veterinarians*. 2006.
7. Songer JG, Glock RD. Enteric infections of swine with Clostridium perfringens types A and C. *Swine Health and Production*. 1998;6(5):223-225.
8. Klobasa F, Werhahn E, Butler JE. Regulation of humoral immunity in the piglet by

- immunoglobulins of maternal origin. *Res Vet Sci*. 1981;31:195-206.
9. Personal communication with Glenn Songer, PhD. May 9, 2006.
10. USDA. Conditional Licenses for Products Containing Clostridium perfringens Type A. Center for Veterinary Biologics Notice No. 02-25. October 31, 2002.
11. Clostridium Perfringens Type A Toxoid. Code 8081.01 Report 5. Field Safety Testing. Novartis Animal Health US, Inc. January 18, 2006.



www.livestock.novartis.com