



# RESEARCH FACTS

RESEARCH & TECHNOLOGY DEVELOPMENT FOR THE CANADIAN BEEF INDUSTRY



## Toe Tip Necrosis in Feedlot Calves

Project Title:

Investigating P3 Necrosis in Feedlot Cattle

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- The lesions of toe tip necrosis in southern Alberta feedlot cattle provide insight into the pathogenesis of the disease; *Canadian Veterinary Journal* 1134–1139

### **Background**

Lameness is the second most costly feedlot health issue after bovine respiratory disease. In addition to treatment and death losses, lame cattle eat less, grow less, convert feed to gain less efficiently, and are more prone to transport injuries. Lameness is also a significant animal welfare concern and has been incorporated into some on-farm welfare audit programs.

There are many different types and causes of lameness, ranging between genetics (e.g. conformation), nutrition (e.g. founder), the environment (e.g. frostbite), and injuries and infection (e.g. footrot, hairy heel wart). Some types of lameness may have several causes, like toe tip necrosis syndrome (TTNS).

TTNS is a specific type of lameness that affects the outside claw of the hindfoot, and typically occurs within one to seven days after arriving at the feedlot. The coronary band at the top of the hoof splits, and the hoof wall often sloughs off after two to four weeks. Very excitable cattle may be more prone to this condition when they damage the soles of their feet while struggling in the chute, but cause and effect may be difficult to separate. It is unclear whether struggling causes the initial injury, or if animals struggle because the foot is already in pain. The disease is sporadic, but tends to cluster by truckload and feedlot pen. Extreme lameness results in a rapid loss in body condition and poor performance. Approximately half of the animals will recover; the remainder are euthanized because of poor performance and concerns about animal welfare.

TTNS is also referred to as P3 necrosis because the infection occurs in the corium surrounding the third phalangeal (i.e. P3) bone at the tip of the hoof. The P3 is comparable to the third bone at the end of a human finger.

## Objectives

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To identify the cause(s) of toe tip necrosis and develop a strategy to prevent and/or control it.

## What they did

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Three veterinary practices in Alberta participated in a case control study from 2012-2014. Veterinarians submitted hooves, heart, and skin samples from animals that were found on postmortem to have symptoms of TTNS (cases) as well as from cattle that died of other causes around the same time as the ones with TTNS (controls). Hoof claw length and sole thickness were measured. Samples were swabbed and tested for the presence of bacteria and heart samples were tested for the presence of bovine viral diarrhea virus (BVDV).

Researchers who were “blind” to whether an animal was diagnosed with TTNS analyzed some of the hind feet for presence or absence of apical white line separation (AWLS). Each hoof was then sliced lengthwise into thin sections. The location, nature and severity of the lesions were described and compared between TTNS-affected and control hooves.

## What they learned

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The white line between the hoof and sole had separated in all of the TTNS-affected hooves, but in only 3% of control hooves. The white line was also significantly thinner in TTNS-affected hooves than in control hooves. In TTNS-affected hooves, tissue in the toe tip was always visibly inflamed, the center of the toe was inflamed about two thirds of the time, and the upper section of the toe was only inflamed about 25% of the time. Microscopic examination only found dead (necrotic) tissue in areas that were also inflamed. There were no signs of smaller, isolated infections apart from the toe tip infections. Unlike foundered cattle, the P3 bone was not rotated in TTNS cases.

There was a very good agreement in diagnosis between researchers who looked at the hooves and field veterinarians, meaning that veterinarians were accurately diagnosing TTNS in the field.

Hooves from cattle with TTNS were found to have a thinner sole in the apical white line region of the hoof. Claws of cattle with TTNS were also 5-7.3 times more likely to be infected with the bacteria *E. Coli* and *treuperella pyogenes*.

When researchers analyzed the hearts of animals that had TTNS they found that they were 4.4 times more likely to be infected with BVDV than cattle who died of causes other than TTNS.

## What it means

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TTNS most likely moves from the outside in. When cattle injure the sole of their feet, the white line thins and weakens resulting in the sole separating from the hoof wall. This study showed that once the bacteria enter the white line, they travel into the foot to infect the P3 bone and other soft tissues. The infection doesn't always end at the foot. Sometimes it spreads up the leg along the tendons and between the muscles, or it may enter the bloodstream and from there can spread to the lungs, liver, and kidneys.

This research helps to better define the causes of TTNS which may eventually lead to better ways of treating and preventing the disease.

By looking at the hoof parameters researchers were able to add further evidence to support the “abrasion theory” that TTNS is caused when the hoof gets excessive wear along the sole creating a point along the white line where the bacteria can enter.

This research also showed that cattle with TTNS were more likely to also have BVDV. BVDV can cause inflammation of the blood vessels, which may result in a poor blood supply to the hoof leading to poor integrity along the white line, leaving it more susceptible to infection. BVDV also causes immunosuppression and immunosuppressed animals may be more susceptible to white line infection. However, BVD and TTNS may be unrelated; calves with TTNS may have been more exposed to BVDV in the sick pen.

A better understanding of TTNS can help to prevent it in the future.

Flooring should provide traction, but must not result in excessive sole wear. Producers should also avoid situations where animals are overcrowded and agitated in the chutes. Considering both the flooring and how the animals are being moved and handled may help prevent costly losses.

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