

Salmonella dublin in Irish cattle

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Salmonella dublin is of concern to public health because it is potentially zoonotic, can have serious animal welfare and economic consequences, and can cause serious disease in humans

INTRODUCTION

The two most common salmonella serotypes in Irish cattle are *Salmonella enterica serovar dublin* and *Salmonella enterica serovar typhimurium*. *Salmonella typhimurium* was found in 11 per cent of isolates, and *Salmonella dublin* in 85 per cent of isolates, of salmonella in Cork Regional Veterinary Laboratory (RVL) over a 10-year period.¹ This article will focus on *Salmonella dublin*. *Salmonella dublin* is host-adapted to cattle and is endemic in the cattle population in Ireland. *Salmonella dublin* is of concern to public health because it is potentially zoonotic and can cause serious disease in humans and also because of its potentially close relationship with *Salmonella enteritidis*. It also can have serious animal welfare and economic consequences.

CLINICAL SIGNS

Salmonella dublin outbreaks can be associated with a number of clinical syndromes. Abortion is the most common clinical entity associated with *Salmonella dublin*, and 70 per cent of the *Salmonella dublin* cases recorded in Cork RVL between October 1989 and December 2003 were associated with abortion.¹ Abortion due to *Salmonella dublin* most commonly occurs in the fifth to eighth months of pregnancy. Every year, approximately 1,000 samples from abortions/stillbirths are submitted to Cork RVL. Approximately 6-14 per cent of these samples culture positive for salmonella.¹

Pre-weaned calves are most susceptible to salmonella infection. However, if the infection pressure is high enough, disease can occur in any age group. Acute infection with salmonella can be associated with a wide range of clinical signs. Pyrexia, pneumonia, inappetence, bloody or watery diarrhoea, joint infections and nervous signs have all been associated with salmonella infection. Acute infection can become clinically chronic. Chronic infections are characterised by failure to thrive, diarrhoea and, in some cases, terminal dry gangrene. In calves, *Salmonella dublin* is most commonly associated with diarrhoea or septicaemia. Death from septicaemia or endotoxic shock is usually associated with a very high bacterial load in susceptible calves.

SPREAD OF THE DISEASE

The most common route of infection is faecal to oral transmission. Infection with salmonella can occur from dam to calf or from a contaminated environment, including, less

commonly, contaminated water, feed or milk. Animals can also become infected via the conjunctiva or the respiratory tract, but these routes are rare. Salmonella bacteria colonise the intestinal tract, where they attach to, and invade, intestinal cells associated with Peyer's patches. From there the bacteria pass into the lymphatic system and enter macrophages where they colonise lymph nodes via the lymphatic system. From lymph nodes, they enter the bloodstream and spread throughout the body.

The highest number of salmonella bacteria are shed in faeces and this is considered the main route of transmission in cattle. Faecal shedding of *Salmonella dublin* starts from one to seven days after infection. The average length of shedding is approximately two weeks in calves and possibly shorter in older animals. A small number of animals can become latently infected and infection can reactivate in response to stress and result in intermittent shedding of bacteria in faeces. Some cattle can become active carriers and continue to shed bacteria for extended periods. These latently infected and carrier animals act as a potential source of infection for other animals in the herd.

DIAGNOSIS

The two most commonly used methods for the diagnosis of salmonella infection in Ireland are culture and serology. The advantage of bacterial culture is that the salmonella serotype can be identified. However, due to the presence of very low numbers of salmonella in the sample, or difficulties in growing the bacteria, it can be difficult to get a diagnosis. Diagnosis of *Salmonella dublin* in post-abortion samples is based on culture of the abomasal contents or brain of the foetus or placenta from the aborting dam. When the foetus is unavailable it is advisable to submit a blood sample from the dam for salmonella serology. Diagnosis is based on salmonella titres and an interpretation of the results is detailed in Table 1.

Table 1: Thresholds for *Salmonella dublin* titres.²

Antigen	Negative	Inconclusive	Positive
Somatic (O)	≤ 1/20	1/40	≥ 1/80
Flagellar (H)	≤ 1/40	1/80 to 1/160	≥ 1/320

The vaccination status of the herd can also complicate interpretation of the blood test results. However, a high proportion of elevated titres can be considered significant.

Bacterial culture of faecal samples can be used to confirm clinical disease. However, unless the animal has salmonellosis or has been clinically affected in the previous few weeks before testing, it is difficult to isolate salmonella bacteria from faecal samples.

TREATMENT

Treatment of animals with clinical salmonellosis relies on using antimicrobials to treat the infection, anti-inflammatories to reduce inflammation and the administration of fluids, if necessary, to maintain hydration status. In calves with salmonellosis, antimicrobial therapy will decrease the severity of the disease and the number of salmonella bacteria shed in faeces.

CONTROL

Control of salmonella must focus on two critical points: reducing the transmission of salmonella to, and among, calves; and reducing the amount of salmonella on the entire farm. To control salmonella in a herd, it is first necessary to know the disease status of the herd. If a herd has regularly submitted samples from abortions and calf diarrhoea cases to the laboratory and there has been no positive salmonella result for five years, then it could be assumed to be free from infection.¹

For herds that are salmonella free it is important that farmers consider measures to prevent the introduction of the disease. Movement of cattle between herds is the main risk factor for introduction of infection into a herd, therefore biosecurity measures should be put in place to limit this risk.

In an infected herd it is important to put management and vaccination measures in place to limit the spread of the disease. The disease is difficult to eliminate from herds as it can survive in carrier animals that shed bacteria intermittently and it survives in the environment for long periods. Carrier cows may shed at stressful times, such as calving, so hygiene of calving pens, calf snatch and calf vaccination are important to protect young stock. Clinical cases should be segregated from the main herd and treated appropriately. Cattle that abort should be isolated for at least a month. However, there is also a risk that these animals may become chronic carrier animals. Products of the abortion should be disposed of in a hygienic manner. Faecal material from clinically affected cows should be prevented from entering the slurry tank, as salmonella can survive for a long time in the tank and for up to 300 days in the soil after spreading. Younger animals, in particular pre-weaned calves, are most susceptible to infection. The most common route of infection for this disease is from cow to calf, therefore control measures should focus on limiting this spread. Heifers infected between the age of one year and first calving are at the highest risk of becoming carrier animals. For these reasons, incorporating the calves and young stock into the vaccination regime is recommended.

VACCINATION

In Ireland, Bovivac-S is the only vaccine available for the control of salmonellosis. Although Bovivac-S is not licensed

for the control of abortion, Crilly and Power³ reported that the proportion of *Salmonella dublin*-positive abortions from vaccinated herds was significantly lower than in herds which were not vaccinating.

Abortions due to *Salmonella dublin* in spring calving dairy herds tend to start in September and peak in October and November. The timing of vaccination, as reported in Cork RVL catchment area, was:

- 7.7 per cent in August
- 10.2 per cent in September
- 14.1 per cent in October
- 19.9 per cent in November
- 17.7 per cent in December
- 10.2 per cent in January.⁴

This would suggest that many herds vaccinate too late in the year and that farmers would benefit from consulting with their veterinary practitioners about the correct timing of vaccination to provide protection before the peak challenge. A strong temporal relationship was observed between drying off and *Salmonella dublin* abortions.¹ It is thought that the stress of drying off can lead to reactivation of latent *Salmonella dublin* infection, which can result in abortion, suggesting that vaccination for salmonella should be done in advance of drying off.

In conclusion, *Salmonella dublin* is a significant pathogen in Irish cattle. Due to its ability to survive in the environment and to latently infect cattle, it is difficult to control and eradicate. Control plans should focus on calf management, on decreasing the overall infection pressure on the farm and on vaccination.

REFERENCES

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