Intestinal spirochaetes in poultry

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Introduction

Reports on the findings that spirochaetes, now recognised as *Brachyspira* spp, were causing typhlo-colitis and diarrhoea with subsequent affects on egg production in chicken flocks, started to appear in Europe in 1986 & 1987, in the Netherlands and the UK, respectively (1, 2). Subsequently, the infections in hens were reported as being caused by *B. pilosicoli, B. intermedia,* and a variety of other species, such as *B. innocens, B. murdochii, B. alvinipulli, B. pulli,* even *B. hyodysenteriae*, normally associated with pigs, sometimes as single infections but often as mixed ones. There have been reports of *Brachyspira* spp infections in other avian domesticated species, such as the turkey (3), goose (4) and duck (5).

This initial work was taken up in particular by the Perth University Team that really explored the incidence of infections in layer and breeder flocks, their epidemiology, pathology, possible contributory factors and also its treatment. As this work was going on, the technology to improve diagnosis and strain differentiation was exploding from microscopy, culture and metabolic profile to genetic markers for PCR work and even MALDI-TOF classification.

Strain pathogenicity has also been an important feature to determine which strains are likely to cause a disease effect and depress egg production or growth. *Brachyspira pilosicoli, B. intermedia, B. alvinipulli* and *B. hyodysenteriae* are considered likely to be pathogenic and *B. innocens* and *B. murdochii* non-pathogenic. However, infection with pathogenic strains did not necessarily mean disease on a flock basis, although individually infected hens may have been affected.

Incidence of infections in chicken flocks

A number of studies have been carried out in Australia, Europe (NL, UK, It), Asia (Malaysia), Colombia and the USA, looking at the incidence of infections, mainly in layer flocks but also in breeders. Commonly spirochaetes can be found in 50-80% of flocks investigated but the pathogenic strains usually in about 25 to 50% of flocks.

In a survey (6) in the UK it was noted that free-range flocks seemed to develop infection earlier, soon after point of lay (22 weeks), in comparison with caged flocks at about 36 weeks of age. So the age of flock tested can have a significant effect on incidence. A study in the US (7) showed that 86% of flocks were infected with potentially pathogenic strains but flocks of over 40 weeks of age were tested.

The type of housing and other factors are also considered important in the transmission of infection and its impact. Free-range hens can go out into ranges, which may have been contaminated previously or may be contaminated by other means, as there is no real means of biosecurity. The hens like to drink from potentially contaminated puddles hence the spread and impact of infection can be quicker and higher. Older caged flocks with deep pit waste disposal also appeared to be at a higher risk and it is thought that contamination by flies of hen feed may be an important infection route. It is often difficult to control flies in these circumstances and also in open-sided sheds as found in hot climates like Asia. Rodents are also considered potential carriers and transmitters of infection (8).

The transmission and infection rate of a flock is considered important. Even if a flock is infected but few birds are affected then it is unlikely to have a major impact on egg production. It is only when a substantial percentage of birds (>20%) are affected that production anomalies start to show. For example in some deep pit sheds 40% of the droppings can be abnormal but in free-range units 80% of the droppings can be affected and consequently lower egg production and increased mortality are reported. In some cage systems, where the droppings are removed from the house and potential contact is less, abnormal caecal droppings can be as low as 1% and production unaffected.

Broiler breeder flocks seem to have a lower infection rate than layers (9) and it is uncommon to find it in broiler flocks or in replacement pullet flocks. This may be due to a number of factors such as improved hygiene or management or the use of anticoccidial drugs, such as the ionophores, which do have activity against *Brachyspira* spp.

Effects on production

In a UK study (10), an untreated layer flock with *B. pilosicoli* showed a 6% reduction in egg production and an increase in mortality of 8.8% in comparison with the breed standard over a complete laying period to 72 weeks of age. A number of authors reported drops in egg production of 5-13%,especially in free-range hens and onset would occur around peak production time. These infections are chronic in nature and the mortality increase is considered a result of this. Broiler breeder flocks can be similarly affected and may affect broiler flock performance subsequently (11).

Treatment and control of infections

A number of antibiotics have been used to treat and prevent the infection with *Brachyspira* spp including ronidazole, lincomycin and tiamulin. Trials have shown the efficacy of these products both in artificial infection studies and in field trials (10, 11).

The minimal inhibitory concentrations (MICs) of a number of antibiotics were reported (12) against 20 *B. intermedia* isolates.

Table 1. Susceptibility (µg/ml) of *B. intermedia* to antibiotics

Antibiotic	MIC 50	MIC 90	Range
Tilmicosin	0.5	2.0	0.125-≥128
Tylosin	1.0	2.0	0.5-≥128
Tiamulin	0.125	0.5	0.031-2.0
Valnemulin	0.063	0.25	≤0.016-0.25
Doxycycline	0.25	2.0	0.063-2.0
Lincomycin	0.5	1.0	0.125-8.0

There was very little resistance development in comparison with *B. hyodysenteriae* from pigs.

Tiamulin was tested against 25 isolates of avian *B. pilosicoli, B. intermedia* and *B. innocens* (13).

Table 1. Susceptibility (µg/ml) of *Brachspira spp* to tiamulin

Antibiotic	MIC 50	MIC 90	Range
B. pilosicoli	0.062	0.25	0.0075-4.0
B. intermedia	0.125	0.5	0.015-8.0
B. innocens	0.062	2.0	0.015-8.0

Similar susceptibility ranges for each species were found.

Following the original extensive use of antibiotics to control the infection, especially in free-range systems in the UK, many practices are trying to reduce antibiotic use in poultry and have explored different methods of control. The inclusion of organic acids, mixtures of probiotics and gut immunity stimulants have been successfully employed.

Discussion

Spirochaetosis appears to be well spread around the world. The type and age of flock is important in recovering *Brachyspira* spp and the severity of the disease. It can cause a reduction in egg production and an increase in mortality, depending on the prevalence of the disease in the flock. Flies and rodents may be helpful in transmitting the infection. Treatment with antibiotics is usually very effective but subsequent breakdown is common, especially if hygiene is not improved. Alternative methods of control are being evaluated and appear to be quite successful.

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