ROSS

ROSS TECH 98/36

NECROTIC ENTERITIS

AND ASSOCIATED CONDITIONS IN BROILER CHICKENS

Necrotic enteritis (NE) is a bacterial disease of broilers that causes mortality and lowered levels of production. To date, these effects have been overcome using digestive enhancers. However, there is now pressure in many markets to eliminate this group of chemicals from broiler production because of a perceived risk to the efficacy of antibiotics. Alternative means are therefore being sought urgently to control NE. Although success has been achieved with certain alternatives, some of these have serious negative economic and welfare consequences.

This Ross Tech describes the incidence and causes of NE in broiler chickens. It discusses control measures in current use and the implications of possible alternatives.

Aetiology

Necrotic enteritis is caused by the bacterium *Clostridium perfringens*. It affects chickens, turkeys, ducks and wild birds. *Clostridium perfringens* is a normal inhabitant of the intestine in low numbers. Under certain circumstances, however, the bacteria proliferate in the intestine and secrete toxins. These toxins cause necrosis of the tips of the intestinal lining. Characteristically, the intestinal lining develops a crusty, velvet-like appearance due to the presence of coagulating necrotic material. (See Figure 1). Various regions of the gut can be affected.

FIGURE 1*: Intestinal Lining. Typical Necrotic Enteritis lesions, demonstrating a crusty, velvet-like appearance.

The main effect of NE is reduced performance but there can also be an increase in mortality. These effects have serious implications on economic efficiency and bird welfare.

NE in Broilers

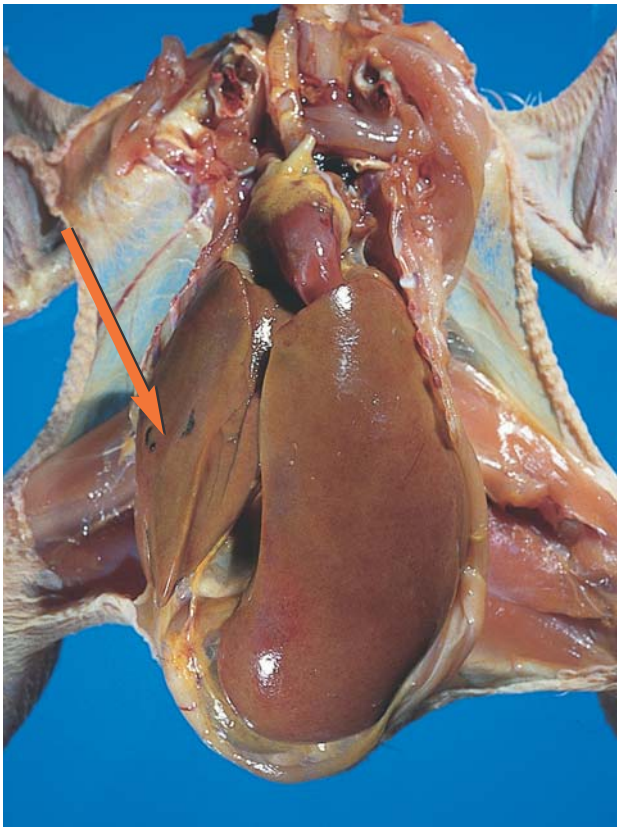
The main effect of NE is to depress performance.

In broilers, NE occurs in an acute or a mild form. In the acute form, birds die without having shown any clinical signs of disease. When NE occurs in the milder form, birds huddle, have ruffled feathers, appear depressed and can stop feeding. If a flock is not treated, the disease can last up to 12 days. Outbreaks can occur as early as 7 days of age, but most occur at 17 or 18 days. Mortality can be as high as 40%. Diarrhoea may be seen in some outbreaks.

Growth rate can be severely depressed and uniformity adversely affected. These effects can be experienced in the absence of significant mortality. NE has also been associated with increased feed conversion ratios.

Some cases of NE which appear mild, can subsequently be linked with increased liver condemnations at processing. Up to 4% of carcases and 12% of livers may be condemned in severely affected flocks. Where these effects are seen, the condition is known as Cholangiohepatitis. The livers are enlarged, pale, firm and mottled. (See Figures 2 and 3). Gall bladders may rupture and present as peritonitis in a small proportion of cases. However, the main effect in these outbreaks is a decrease in performance.

FIGURE 2*: Jaundiced broiler carcase post mortem showing Cholangiohepatitis. The liver is enlarged and firm. Distended bile ducts (seen as a blue colour), are visible in the right lobe.



Causes of NE

It is thought that the slowing down of the gut flow (i.e. gut stasis) during the normal process of digestion allows the Clostridium bacteria to proliferate. Factors increasing the viscosity of the gut contents, e.g. ingestion of certain types of wheat, further encourage this proliferation and predispose to the occurrence of NE. Outside the bird, in the environment (i.e. feed, litter, etc), Clostridia will form spores which are extremely resistant to desiccation, chemicals and temperature. These spores present the risk of infection and re-infection.

A summary of factors thought to influence the occurrence of NE is provided in Table 1.

FIGURE 3*: Liver and intestine of normal (i.e. lower left) and age-matched bird with Cholangiohepatitis. In the affected liver, a distended bile duct has been incised to show the material causing enlargement.

NE in Parent Stock

NE occurs occasionally in broiler parent stock during the rearing period. As well as causing an increase in mortality, it may lead to uniformity problems, which reduce subsequent peak production. Sometimes there can also be an underlying problem of coccidiosis notably caused by *Eimeria brunetti.* In such cases the distribution of NE lesions follows that of the coccidial infection.

TABLE 1
FACTORS ASSOCIATED WITH OCCURRENCE OF NE

FACTOR	EFFECT	COMMENT	*THE FUTURE*
Digestive enhancers (and antibiotics)	Decrease clostridia numbers in gut. Antibiotic resistance may develop.	These substances have been used to control NE. Rotation may be needed to maintain efficacy.	*In the future digestive enhancers may not be available.*
Coccidiostat	Polyether ionophores control coccidiosis and also have an effect on clostridia. Narasin can decrease NE even in the absence of coccidial challenge.	Type of coccidiostat used can markedly affect the likelihood of an NE outbreak.	*Complete removal of coccidiostats from broiler diets with the introduction of coccidial vaccines may increase the incidence of NE.*
Coccidiosis	Transit time of feed through gut is increased in coccidiosis.	Coccidiosis control.	*The introduction of coccidiosis vaccines for broilers may increase the incidence of NE if no steps taken to replace control of NE currently afforded by coccidiostats.*
New feed additives e.g. plant derivatives	Suggested to decrease incidence of NE.	New compounds from natural sources may be acceptable to consumers.	*The development of new feed additives compounds may be helpful.*
Consumption of high energy and protein diets	High nutrient density diets can increase the occurrence of NE. Diets high in fishmeal classically predispose to NE.	Currently in Scandinavia broiler diets have lower metabolisable energy (ME) and crude protein (CP) levels.	*Strategies must be developed which allow high nutrient density diets to be fed without digestive enhancers.*
Dietary changes (i.e. from starter to grower)	Dietary changes predispose to outbreaks of NE.	Abrupt changes in feed texture or composition should be avoided.	
Maize	Inclusion of maize in broiler diets reduces the incidence of NE.	Gut function in young birds is not as developed as in adults. Maize is more readily digested by young birds than alternative cereals e.g. rye, barley, wheat.	*Maize inclusion may offer advantages, particularly in starter diets.*
Season	Some studies have demonstrated an increase in NE in spring and summer.	This may be confounded by new season cereals.	*Usually not important in most areas. Enzyme treatment of cereals may reduce this effect.*

FACTOR	EFFECT	COMMENT	*THE FUTURE*
Grinding of cereals	Roller milling decreases NE compared with hammer milling.	This may be an effect of particle size, which would affect transit time, viscosity etc.	*Roller milling is preferred.*
Enzyme supplementation	Thought to reduce NE by effect on gut content viscosity.		*Optimisation of enzyme types and inclusion rates in diets will be necessary.*
Competitive exclusion (CE)	Defined microflora and undefined products may decrease NE.	Current CE products require evaluation.	*Greater dependence may be placed on the use of CE products if digestive enhancers are not permitted.*
Stress	Outbreaks often occur at times of management change (e.g. change of feed) or critical development stage (e.g. point of lay).	Management should always be aimed to minimise stress.	*Management must be planned to minimise stress.*
Stocking density	Increased stocking density can increase the incidence of NE.		*Stocking density must be optimised.*
Nipple drinkers	Nipple drinkers decrease NE incidence.	This effect may be through hygiene and litter quality.	*Good drinker management is required.*
Litter material	Some litter materials may increase incidence of NE, due to differences in texture, cleanliness etc.	Consideration should be given to whether or not outbreaks of NE are associated with a change in litter material. Factors predisposing to litter eating must be controlled.	*The effect on the incidence of NE must be taken into account when selecting litter material.*
Litter quality	NE is more likely to occur when litter quality is poor.		*Litter management is important in the control of NE.*
Coarse material in diet	Ingestion of coarse material such as litter, foreign bodies etc.		*Feed quality must be managed carefully.*
Cleaning out	*Clostridia perfringens* type C is thought to only proliferate in the intestine of animals and be carried over in faecal material.	Clostridial spores are highly resistant to disinfection.	*Standards of cleanliness should be reviewed after NE outbreaks.*
Turn-around time	Short turn-around times increase NE.	Spores are resistant so this probably reflects the standard of cleaning out.	*Turn-around time should be optimised in terms of commercial expediency and eradication of Clostridial spores.*
Genotype	MHC* associated susceptibility has been described in White Leghorns.	Currently undergoing investigation in other strains.	*Genetic selection for resistance to NE may be a future option.*

*Major Histocompatibility Complex

CONTROL AND TREATMENT

DIGESTIVE ENHANCERS

The use of digestive enhancers in broiler rations has had the positive side effect of controlling the occurrence of NE, and this effect has been used in prevention and control of the condition. This control and prevention has been based on rotational use of digestive enhancers such as Avilamycin, Zinc Bacitracin or Virginiamycin. (See Table 2). A gradual decrease in efficacy has been seen when some digestive enhancers are used for a prolonged period.

At present, the therapeutic agents of choice are water soluble penicillin derivatives. Resistance to penicillins is very rare. The efficacy of penicillins against *Clostridia perfringens* is extremely good. Therapeutic responses to penicillins are dramatic, with improvements in performance and cessation of deaths. Most other antibiotics also have some activity against Clostridial bacteria but antibiotic resistance may develop. Typically, the antibiotics such as tetracyclines, dimetridazole and lincomycin can also be used.

Digestive enhancers have antibiotic properties but are used at very low inclusion rates. In Europe there has been a trend to use digestive enhancers that are not related to those antibiotics used in the treatment of humans.

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TABLE 2
SOME DIGESTIVE ENHANCERS IN CURRENT USE IN BROILER CHICKENS

Digestive Enhancer	Current Status in Europe	Related Antibiotics in Human Use
Avilamycin	Registered	Everninomycin (currently being developed)
Avoparcin	Recently removed from use in Europe	Vancomycin Teicoplanin
Bambemycins	Registered	No human use
Penicillins	Not in Europe	Numerous
Tetracyclines	Not in Europe	Numerous
Virginiamycin	Authorisation for use in EU withdrawn from 1/1/99, with a transitional period of six months, up to 1st July, 1999, being allowed for use to be phased out	Pristinamycin (currently being developed)
Zn Bacitracin	Authorisation for use in EU withdrawn from 1/1/99, with a transitional period of six months, up to1st July, 1999, being allowed for use to be phased out	Currently used

In human medicine, the development of new antibiotics related to Avoparcin, Avilamycin and Virginiamycin has precipitated the re-evaluation of the use of these products for poultry.

The widely debated issue of whether the use of digestive enhancers contributes to the development of antibiotic resistance in human pathogens is beyond the scope of this Ross Tech. The use of such chemicals in broiler production is now becoming unacceptable in some markets, and it is assumed that the complete removal of antibiotics from the treatment of food producing animals may be inevitable in all markets in the future.

Anticoccidials

The inclusion of the polyether ionophore group of coccidiostats in feed has also had a beneficial effect in the control of NE. The association of NE with coccidiosis as described earlier, has in the past, demonstrated the importance of the inclusion of coccidiostats in broiler diets. The development of commercial coccidial vaccines for broilers will eliminate the need for this practice in future, and may lead to increased incidence of NE unless other methods of prevention are used.

Alternative Approaches

A lesion scoring system to monitor NE is useful in evaluating the efficacy of disease control.

Development of a vaccine for NE has not been successful to date.

Certain products derived from plants are showing some promise as replacements to digestive enhancers.

The Future

Pressure to eliminate the use of digestive enhancers from broiler production because of a perceived risk to the efficacy of antibiotics means that alternative strategies to the control of NE are needed urgently. Some success has been achieved but some of the alternative strategies have negative economic and welfare consequences. Methods of producing broilers without the necessity for chemicals such as digestive enhancers and anticoccidial drugs will ensure access for broiler products to the widest possible range of markets.

The solution to the problem must take into account economics, welfare, practicality and the consumers' desire for chemical-free production. This could include novel dietary and management practice. A genetic approach to the problem may deliver results in the longer term.

Research is also needed to determine the effects of feed contaminated with clostridial spores on the incidence of this disease. Clostridial spores are extremely resistant to destruction by desiccation, chemicals and extremes of temperature but alternative methods of feed decontamination may prove effective.

Currently research is being directed towards the problem of NE and involves a combination of management, nutritional and genetic strategies. In the short term, broiler operations should monitor the incidence of NE closely and respond rapidly to the observation of NE or cholangiohepatitis because of the concurrent economic effect. The suggestions in this Ross Tech are aimed at providing a better understanding of and therefore control of this problem.

**Figures 1-3 reproduced by kind permission of VLA Lasswade*

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