Necrotic Enteritis: a Review

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Boxmeer, the Netherlands
Necrotic Enteritis

Condition caused by the toxins of Clostridium perfringens

Results in damage of the intestinal mucosa (thickened and lined with a pseudomembrane; severe necrosis with formation of diphtheric membrane)
Economic losses:

• loss weight gain, higher time to market, poor flock condition, increased mortality, increased production costs (low feed conversion, antibiotics), secondary infections, etc.
Digestive Tract Structure

- Villi
  - Absorptive surface increased by finger-like folds in the lining

Courtesy of Dr. Fred Hoerr, AVDL
Intestinal villi
Healthy Intestine
Electron picture of VILLI: good!
Electron picture of VILLI: poor!
Healthy Intestine
Necrotic Enteritis
Necrotic Enteritis
Normal
Necrotic Enteritis
Alpha Toxin

Cholangiohepatitis
Clostridium spp.

- Bacteria
- Rod-shaped
- Spore-forming
- Gram-stain positive
- Anaerobic
Clostridium lives in soil

...also poultry dust, feed, feces, litter.
Clostridium prefers high pH

Mississippi River USA

SE Asia

Egypt

Europe

China

Mexico

...this is necrotic enteritis country
Anaerobic culture

- Use special anaerobic culture swabs
- Swab fresh intestinal contents or intestinal wall
- Submit to lab ASAP to avoid overgrowth
- Samples in formalin.
- Do not take blood samples.
- New diagnostic kits???
Clostridium hemolyzes red blood cells
Clostridium produces toxins that attack cells
<table>
<thead>
<tr>
<th>Cp Type</th>
<th>α</th>
<th>β</th>
<th>ε</th>
<th>ι</th>
<th>Associated Pathology</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>++</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Diarrhea (foals, pigs…) Necrotic Enteritis in poultry</td>
</tr>
<tr>
<td>B</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>Dysentery in newborn lambs Hemorrhagic enteritis in newborn calves and foals Enterotoxemia in sheep</td>
</tr>
<tr>
<td>C</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>Necrotic enteritis in piglets, lambs, calves, and foals Enterotoxemia in sheep Necrotic Enteritis in poultry</td>
</tr>
<tr>
<td>D</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>Enterotoxemia in lambs, sheep, calves and goats</td>
</tr>
<tr>
<td>E</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>Enterotoxemia in calves</td>
</tr>
</tbody>
</table>
Present in normal intestinal microflora
Some may not be able to produce toxin
Natural non-toxin producing strain
May only produce toxin when “turned on”
“Incidence of infection is low and probably depends on injury or infection to destroy tissue”

“Clostridial infections are not thought to be common in birds, and economic loss is small”
1991 Print

• Chapter 11 – Clostridial Diseases
  - Complete Sections on Gangrenous Dermatitis and Necrotic Enteritis

• Current Poultry Industry Health Surveys
  - Necrotic Enteritis Makes the “Top 5 List” in All of Them
Necrotic Enteritis

Clinical
- Mortality
- Morbidity

Subclinical
- Reduced weight
- Reduced growth rate
- Impaired FCR

Hofacre
What contributes to NE?
Coccidiosis

- Disease of the digestive tract of susceptible hosts
- Any age susceptible
- Caused by one or more species of Eimeria.
- A self-limiting disease
- Important and costly diseases
- Man-made disease
Coccidiosis Factors

- Excessive subclinical coccidial presence
- High oocyst counts and microscopic tissue damage during the 4th and 5th weeks.
Coccidiosis Factors

NE occurs here!
Broiler Growth Curve

Early

Late

Ross 308

Days

0 7 14 21 28 35 42 49 56

Days

0 7 14 21 28 35 42 49 56

Ross 308

Days
Which Cocci Opens the Door for N.E.?

% Necrotic Enteritis Mortality

Dr. Chuck Hofacre
Coccidiosis Factors

Manage by:

Coccidiosis vaccination programs
Reduced in-feed antibiotic efficacy due to:

- Intensive use of antibiotics (wheat ration, yellow bird programs, Clostridium-prone environments)

- Half-level use to reduce cost
Reduced Antibiotic Sensitivity

Manage by:

- Alternative antibiotic strategies
- Enradin!
Nutritional Factors

High protein diets – source of proteins

Higher the Protein – the easier to induce NE outbreak

High Levels of Animal By-Products (Fishmeal, Meat & Bone Meals)

Animal By-Products Commonly Heavily Contaminated with *Clostridium sp.* Spores
Nutritional Factors

Protein Source and Quality

Manage by:

• Feeding lower protein and higher (synthetic) amino acid
• Feed all vegetable diets to flocks at risk
• Avoid questionable quality by-products (hairs in gizzard!)
• Avoid Trypsin inhibitors in soybean meal
Grain Source and Quality

High Levels of Specific Grains

- Wheat
- Rye
- Barley
Nutritional Factors

Grain Source and Quality

Wheat, Barley, Rye:

• Increased Intestinal Irritation
• Decreased Digestibility
• More Nutrients for the Clostridia Organism
• Increased Mucous Production
Goblet cells

W/R: ileum (100 x)  M: ileum (100x)

Prof. Ducatelle
Nutritional Factors

Grain Source and Quality

Manage by:

• Enzymes, microflora treatments to improve digestibility

• Avoid these grains in flocks at risk!
Nutritional Factors

Dramatic Change in Diet
Starter to Grower Change

• Common to See Diarrhea With This Feed Change
• Dramatic Changes in Diet Formulation
• Results in Increased Intestinal Irritation or Mucous Production
Management Factors

Litter Type and Condition
Rice or Oat Hulls

• Increased Consumption by Birds
  - Increased Cocci/Bacteria Challenge
  - Increased Intestine Irritation
Management Factors

Litter Type and Condition

Increased Litter Moisture

• Increased Cocci Challenge
• Increased Bacteria Growth
• Litter Moisture Secondary to Diarrhea
Litter Type and Condition

Manage by

• Avoid the more edible litter in flocks at risk

• Close monitoring and management of litter in flocks at risk
# Necrotic Enteritis

## Summary

<table>
<thead>
<tr>
<th>Cause</th>
<th>Other factors</th>
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<tbody>
<tr>
<td>C. perfringens</td>
<td>Infectious agents</td>
</tr>
<tr>
<td></td>
<td>Managerial</td>
</tr>
<tr>
<td></td>
<td>Nutritional</td>
</tr>
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<td></td>
<td>In-feed preventive treatment</td>
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Netvax

NE Control by Vaccination
How does NETVAX fit into the NE picture?
Background

- Oil emulsion for injection
- Contains *Clostridium perfringens* type A alpha toxoid (>6.8 IU HIA)
- 0.5 ml administered by intramuscular injection into the breast
- First dose to be given at 10 to 14 weeks of age
- Second dose to be administered 4 to 10 weeks after the first vaccination and no later than 6 weeks before the onset of lay
Indications for Use

• For the active immunization of chickens to provide passive immunisation against necrotic enteritis to their progeny, during the laying period

• To reduce mortality and the incidence and severity of lesions caused by *Clostridium perfringens* Type A induced necrotic enteritis
Reduced impact from early *C. perfringens* growth may alter the dynamics of intestinal microflora through the life of the flock.

Days of age
Maternal antibody protection for early challenge

May prevent tissue damage that encourages further C. perfringens growth or toxin production that would cause problems later.
• Improved livability
• Improved weight
• Improved feed conversion
To use an efficient AGP
Antibiotic Growth Promotant
ENRADIN®
The most effective antimicrobial feed additive against
Clostridium perfringens

Intervet
Schering-Plough Animal Health
ENRAMYCIN CHARACTERISTICS

• ACTIVE INGREDIENT: ENRAMYCIN
  - PRODUCED BY STREPTOMYCES FUNGICIDICUS

• POLYPEPTIDE ANTIBIOTIC
  - ANTIBACTERIAL ACTIVITY INHIBITS BACTERIA WALL FORMATION (PEPTIDOGLYCNANS).

• ACTIVE ON GRAM+ BACTERIA
  - SELECTIVE SPECTRUM → MANY MAJOR ENTERIC PATHOGENES ARE G+
    (Clostridium, Streptococcus,...)

• VERY ACTIVE ON CLOSTRIDIUM PERFRINGENS
  - NECROTIC ENTERITIS (clinical as well as sub clinical)
Gut, no enramycin

Pathogenic bacteria's

Non-pathogenic bacteria's
Action

enramycin

Non-pathogenic bacteria's

Pathogenic bacteria's
# Antibacterial activity of Enramycin

<table>
<thead>
<tr>
<th>Kind of bacteria</th>
<th>Culture condition</th>
<th>TSA(^a)</th>
<th>AAM(^b)</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>Aerobic</td>
<td>Anaerobic</td>
</tr>
<tr>
<td><em>Staphylococcus aureus</em> 209P</td>
<td></td>
<td>1.56</td>
<td>1.56</td>
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<tr>
<td><em>Staphylococcus aureus</em> 308A-1</td>
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<td>0.78</td>
<td>0.78</td>
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<tr>
<td><em>Staphylococcus aureus</em> 1840</td>
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<td>1.56</td>
<td>0.78</td>
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<tr>
<td><em>Staphylococcus aureus</em> DHN-1</td>
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<td>3.13</td>
<td>1.56</td>
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<tr>
<td><em>Staphylococcus aureus</em> CH-91</td>
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<td>1.56</td>
<td>1.56</td>
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<tr>
<td><em>Streptococcus pyogenes</em> E-14*</td>
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<td>0.78</td>
<td>0.39</td>
</tr>
<tr>
<td><em>Streptococcus pyogenes</em> Dick*</td>
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<td>0.39</td>
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<tr>
<td><em>Streptococcus pyogenes</em> S-8*</td>
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<tr>
<td><em>Streptococcus pyogenes</em> NY-5*</td>
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<tr>
<td><em>Streptococcus viridans</em></td>
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<tr>
<td><em>Diplococcus pneumoniae</em> type I*</td>
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<td>0.39</td>
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<tr>
<td><em>Diplococcus pneumoniae</em> type II*</td>
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<td>0.39</td>
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<td>0.39</td>
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<tr>
<td><em>Bacillus subtilis</em> PCI-291</td>
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<td>1.56</td>
<td>1.56</td>
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<tr>
<td><em>Clostridium perfringens</em> PB6K</td>
<td></td>
<td>—</td>
<td>0.2</td>
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<tr>
<td><em>Clostridium perfringens</em> 7-Heart</td>
<td></td>
<td>—</td>
<td>0.2</td>
</tr>
</tbody>
</table>

\(^a\) Tripticase soy agar (BBL)
\(^b\) Anaerobe agar medium (Eiken)
\(^c\) Gas-Pack system (BBL)
*Addition of 5% bovine blood
MIC Comparison of Clostridium perfringens between Enradin F-80 and Avilamycin in samples collected from farms using Avilamycin
# Recommendations

<table>
<thead>
<tr>
<th></th>
<th>Period</th>
<th>Feed Rate</th>
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| **Broilers** | • Starter  
              • Grower  
              • Finisher                                                 | • 6 or 8 ppm  
                                    • 4 or 6 ppm  
                                    • 3 or 4 ppm |
| **Breeders** | • Start : Until 4 weeks  
                              • From 5 to 18 weeks  
                              • From 19 to 24 weeks  
                              • During the production of eggs                            | • 10 ppm  
                                    • 8 ppm  
                                    • 6 ppm  
                                    • 4 ppm |
| **Layers**  | • During lay                                                            | • 5 ppm            |
Remember

• Use higher dosage in the pre-starter and the starter feed.

• Avoid big changes in dosage between different feeds:
  – Starter feed : 10 ppm
  – Grower feed : 4 ppm  NO!

• Do not make bigger differences between feeds than 3 ppm.
  example
  – Starter feed : 10 ppm
  – Grower feed : 7-8 ppm

• If you can use a growth promotant in slaughter feed, then Enramycin is the best product for this situation. Use only 3 or 4 ppm, it's sufficient.

• You can use Enradin in rotation programs : Change 6 months
Conclusion: ENRADIN F-80

- Acts in very low dosage;
- Not absorbed in the gut;
- No residue in the meat;
- Not used in human or veterinary therapy;
- No resistance reported;
- Acts effectively in G+ organisms;
- Stable during the pelleting process and in feeds;
- Reduces wet droppings in poultry;
- Depresses ammonia-producing organisms, thereby reducing ammonia levels in the intestinal contents and blood;
- Improve performance.
Follow the Leader in intestinal health!

THANK you all for your attention
Thank you very much!

www.ihc-poultry.com