Overview of Gangrenous Dermatitis in Broilers And Strategies for Prevention

Eric L. Jensen, DVM, MAM, Diplomate, ACPV
Associate Veterinarian
Ross Breeders, Inc.

INTRODUCTION
Gangrenous dermatitis (GD) is a bacterial disease affecting poultry characterized by areas of necrosis in the skin and underlying tissues, usually resulting in death. The disease has been reported in commercial layers, turkeys, and broiler breeders but most frequently occurs in rapidly growing broilers between 4 and 8 weeks of age. Gangrenous dermatitis is known by many names including necrotic dermititis, gangrenous cellulitis, avian malignant edema, “wing rot,” or “blue wing.”

A wound to the skin followed by secondary bacterial infection with Clostridium septicum, Clostridium perfringens type A, or Staphylococcus aureus, alone or in combination, initiates the disease. Clostridia are part of the normal flora of the chicken gut and are usually found in soil and contaminated litter. Staphylococcal bacteria are everywhere; existing on the chicken’s skin, intestine, and in the chicken house environment.

Susceptibility to infection is increased when the immune system is compromised. Therefore, this disease is seen most often following infection with immunosuppressive agents like chicken anemia virus (CAV), infectious bursal disease virus (IBDV), reticuloendotheliosis virus (REV), avian adenovirus, reovirus, and Marek’s disease. Other stresses such as mycotoxins (particularly aflatoxins), coccidiosis, environmental extremes, nutritional deficiencies, and other management problems can also result in depression of the immune system and contribute to a higher incidence of GD.

SIGNS AND DIAGNOSIS
In most cases, this problem appears in 28 day-old broilers and can continue until the flocks go to processing. A diagnosis
can generally be made based on the history, clinical signs, and typical gross lesions. Affected birds will be depressed, weak, off feed, and often demonstrate ataxia. The period of illness is quite short with most birds dying within 24 hours. The lesions will appear as dark, purple to black, moist areas in the skin. Typically the feathers will be missing or very easy to remove over the affected areas. The subcutaneous tissue will contain pink or straw-colored fluid and gas (emphysema) is frequently present. The underlying muscle will be discolored gray or tan. Lesions most commonly occur on the abdomen, hip, breast, legs, and wings. Histopathology or isolation and identification of the causative agent(s) can confirm the diagnosis. For isolation, birds can be submitted to a diagnostic laboratory or samples of the affected muscle and subcutaneous tissue can be collected and shipped using an anaerobic transport tube.

Differential diagnosis is not difficult as very few diseases have a similar presentation. It is interesting to note that there are many similarities between GD and cellulitis (also known as infectious process). Both diseases are produced by bacterial infection secondary to skin damage and occur more frequently following immunosuppression. The primary difference being the type of bacteria causing the infection (E. coli in the case of cellulitis). Therefore, many of the preventive measures are the same for both diseases.

**PREVENTION**

GD can occur in all breeds and breed crosses of meat-type birds (both slow and fast-feathering). Two determining factors that may be associated with the contraction of GD are sex and breed type. In feather sexable breeds, the slow-feathering broiler males may be more vulnerable to skin injuries due to a longer period of exposure prior to feather coverage than females, which are fast feathering. Also, male broilers may have a higher frequency of GD because they gain weight faster, are heavier and are more aggressive than females, although the females have more fragile skin.

Efforts to prevent GD should be focused on limiting the level of bacterial challenge, boosting immune system function, and minimizing the number of wounds and/or scratches to the skin through nutrition and management factors as described below:

**A. Immunosuppression**

As stated previously, it is well documented that impaired function of the immune system will contribute to an increase in the incidence of GD. Many viral agents can affect the immune system, with both CAV and IBDV being particularly harmful.

Significant immunosuppression may occur if birds are exposed to CAV early in life or infected through vertical transmission. Also, chicks lacking maternal immunity are more susceptible to clinical disease and immunosuppression. Therefore, it is imperative that every breeder flock is tested for seroconversion before the onset of egg production. The flock status can be quickly determined using any of the commercial ELISA test kits now available. Previously, producers have had to rely on natural exposure, litter transfer, or autogenous vaccines to immunize flocks; all of which may produce variable results or unwanted side effects. Recently, the first USDA licensed vaccine became commercially available (CAV-VAC, tradename of Intervet, Inc.). This valuable tool will help ensure successful and timely seroconversion to CAV in all breeder flocks.

**TREATMENT**

Mortality can vary but is typically 0.25 to 1.75% per day. Because the mortality often continues until slaughter, treatment may be required. Penicillin has proven to be very effective in controlling GD. Other antibiotics that have been used include erythromycin, tetracycline, lincomycin, and tylosin. Selenium has also been used as a treatment.
Control of IBDV requires the transfer of sufficient levels of maternal antibody to protect against early field challenge. A typical vaccination program for parent stock includes two live vaccines and two or more inactivated vaccines containing bursal-derived, standard and variant IBDV strains of virus before the onset of production. In many areas, broilers may require a field boost with standard and/or variant live vaccines to provide continued protection once the maternal antibody has diminished.

B. Nutrition
The following nutritional/feed factors impact the incidence of GD because of their influence on feathering, skin strength, and immunocompetence:

1) **Protein** — Both feathers and skin are composed primarily of protein (keratin). Adequate protein (20-22% of diet) with an appropriate balance of essential amino acids in the starter ration will promote adequate feather development and increase skin strength (see nutritional recommendations per the Ross Broiler Management Guide).

2) **High energy** — High-energy feed (low protein to calorie ratio) may marginalize protein intake. Excessive energy in the diets also increases fat deposits in the skin causing increased skin fragility.

3) **Vitamin E** — A sufficient level of vitamin E is important for development of the immune system and also protects the birds’ cells against oxidative compounds (originated from rancid fat or tissue damage). The recommended level in broiler starter rations is 23-34 IU/lb. Recent research indicates that levels as high as 55-125 IU/lb. may provide additional benefit (Vitamin E and Immunocompetence in Broilers, RossTech, April 1997).

4) **Animal by-product** — The level of protein in animal by-product is variable and will result in some batches of feed being marginal in protein. These products can also be the source of bacterial contamination, rancid fat, and biogenic amines.

5) **Fat rancidity** — Use of rancid fat will cause increased utilization of vitamin E (through oxidation) and rapid feed transit (therefore, decreased nutrient uptake). Antioxidant (such as ethoxyquin) must be added to all fat sources and incorporated into the feed at 125 PPM.

6) **Salt** — Insufficient salt in the feed may lead to hysteria and increased cannibalistic behavior (see nutritional recommendations per the Ross Broiler Management Guide).

B. Management
Numerous management factors as described below can also influence the occurrence of GD by an increased risk of skin wounds and/or additional bacterial challenge.

1) **Stocking density** — High density is directly correlated to increased skin damage. Broilers should be placed at no more than 5-6 lbs./sq. ft., depending on liveweight at slaughter. See Table 1.

<table>
<thead>
<tr>
<th>Liveweight (lb.)</th>
<th>Floor Space (sq. ft.)</th>
<th>Lbs./sq. ft.</th>
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<tbody>
<tr>
<td>3.0</td>
<td>.50</td>
<td>6.00</td>
</tr>
<tr>
<td>4.0</td>
<td>.70</td>
<td>5.71</td>
</tr>
<tr>
<td>5.0</td>
<td>.90</td>
<td>5.56</td>
</tr>
<tr>
<td>6.0</td>
<td>1.10</td>
<td>5.46</td>
</tr>
<tr>
<td>7.0</td>
<td>1.30</td>
<td>5.39</td>
</tr>
<tr>
<td>8.0</td>
<td>1.60</td>
<td>5.00</td>
</tr>
</tbody>
</table>

2) **Coccidiosis control** — Adequate control is important as coccidiosis causes stress, immunosuppression, malabsorption, and secondary nutritional deficiencies. Coccidiosis may induce a vitamin E deficiency by interfering with absorption and causing increased utilization due to oxidation caused by damage of the intestinal cell walls.
3) **Lighting programs** — These are important for controlling growth rate and reducing bird activity. Lighting programs can help to reduce excitability, physiological stress, and improve immunity (due to light-dark induced melatonin release). See Table 2.

<table>
<thead>
<tr>
<th>Age</th>
<th>Dark Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 3</td>
<td>None</td>
</tr>
<tr>
<td>4 – 14</td>
<td>9 p.m. – 5 a.m.</td>
</tr>
<tr>
<td>15 – market</td>
<td>2 a.m. – 5 a.m.</td>
</tr>
</tbody>
</table>

Typical lighting program for 40–42 day old broilers at market

4) **Feed and water outages, loud noises, and bird migration** (from tunnel ventilation) — These cause the birds to pile or crowd together and must be prevented by adequate management practices. Also, ensure sufficient feeder space and avoid harsh feed restriction programs.

5) **Heat and humidity** — High environmental temperature causes stress and reduces feed consumption (inadequate nutrient intake) which may result in poor feathering and immunosuppression. Excess moisture in the litter promotes bacterial growth. Adequate ventilation and use of nipple drinkers can improve environmental conditions.

6) **Farm hygiene** — Improved cleaning and disinfecting practices, more frequent litter replacement, longer downtime (see Table 3), and water chlorination will decrease the level of bacterial challenge. Litter acidification has been shown to reduce bacterial challenge and can be accomplished by applying aluminum sulfate at 10 lbs./100 square feet or sodium bisulfate at 5 lbs./100 square feet. Salt applied at the rate of 5-6 lbs./100 square feet has also been used to limit bacterial growth. Mortality from GD must be collected a minimum of twice per day, otherwise, spores produced by Clostridia in the carcass will result in heavy environmental contamination.

<table>
<thead>
<tr>
<th>Growout Days</th>
<th>Broods Per Year</th>
<th>Downtime Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>42</td>
<td>6.5</td>
<td>14</td>
</tr>
<tr>
<td>49</td>
<td>5.8</td>
<td>14</td>
</tr>
<tr>
<td>56</td>
<td>5.2</td>
<td>14</td>
</tr>
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</table>
**SUMMARY**

Gangrenous dermatitis continues to be a significant health problem for many broiler operations. Its sporadic nature can make determining the contributing factors difficult. Therefore, it is important to fully document each case to better understand the factors involved. Key approaches to limiting the problem should include improved control programs for CAV, IBDV and coccidiosis; improved farm hygiene; concentration on management factors, particularly nutrition, stocking density, and lighting programs; and improved control of environmental conditions.

**KEY POINTS FOR PREVENTION**

**Immunosuppression**
- ✔ Minimize the risk of early exposure to CAV and IBD as much as possible
- ✔ Test for seroconversion to CAV before the onset of egg production in all breeder flocks
- ✔ Bolster the breeder vaccination program for CAV and IBDV
- ✔ Administer booster IBDV vaccines to broilers if maternal antibodies diminish

**Nutrition**
- ✔ Ensure protein levels of 20-22% for skin strength and feather development
- ✔ Avoid excessive energy levels which increase fat deposits and exacerbate skin fragility
- ✔ Provide 23-34 IU/lb of Vitamin E in starter ration to boost the immune system
- ✔ Assess the quality of animal by-product protein sources which vary in composition and may be contaminated with biogenic amines
- ✔ Test for and prevent fat rancidity which can deplete reserves of vitamin E
- ✔ Ensure sufficient salt intake to prevent hysteria and cannibalistic behavior

**Management**
- ✔ Ensure proper stocking density to prevent skin damage
- ✔ Control coccidiosis to prevent stress, malabsorption, and secondary nutritional deficiencies
- ✔ Implement a lighting program to help control growth rate and activity and ensure the adequate development of the immune system
- ✔ Avoid feed and water outages, loud noises, and bird migration which cause crowding
- ✔ Ensure adequate ventilation to minimize heat and humidity
- ✔ Maintain good farm hygiene and treat litter as needed
- ✔ Remove daily mortality as quickly and as often as possible
GLOSSARY OF TERMS

ataxia — uncoordinated movement

autogenous — local virus propagated in a laboratory

biogenic amines — waste products of bacterial growth

histopathology — microscopic examination of affected tissues

seroconversion — development of immunity

REFERENCES


