UPDATE ON THE RUNTING - STUNTING SYNDROME

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INTRODUCTION

Considering different factors that influence the development and maturation of the digestive system and intestinal health of the chick during the first 2 to 3 weeks of life, it is necessary to include genetics, management, nutrition, maternal antibody status and disease control programs. Also, the nutritional status of the breeders is essential for transferring to the fertile egg and future chick a balanced source of nutrients facilitating the normal development of different systems of the embryo including the intestinal tract.

HISTORY

A disease typically affecting young broilers commonly known as Runting Stunting Syndrome (RSS) has been reported for many years in major poultry producing areas worldwide. Recent studies in the U.S. have described outbreaks of RSS based on histological evaluations of acutely affected broilers characterized by a cystic enteritis and enteropathy.
The first clinical signs may be observed as early as 3 days of age but are most commonly seen in 6 to 12 day-old chicks and may last up to 3 weeks of age. An increasing number of uneven and undersized birds are noticeable, often characterized by cloacal pasting and fecal stripes.

Wet undigested feed passage is evident in the litter and the presence of diarrhea, watery droppings and excess flushing results in wet litter and excess caking. The chicks are frequently pale, dirty and wet and may have a distention of the abdomen.

Birds may huddle together in the drier parts of the poultry house to keep themselves warm. This condition may be more prevalent during winter and early spring. Mortality and aggressive culling may reach up to 60% and feed conversion may be decreased 20 points with the consequent economic losses.
GROSS LESIONS

Upon necropsy of sick birds, several gross lesions may typically be observed: Pale small intestines with thin, transparent walls and ballooning due to gas accumulation. Gross lesions in the duodenum are usually mild. The jejunum and ileum are most affected but the ceca may also be gaseous and distended. Lymphoid cell depletion in thymus, bursa of Fabricius and spleen are common but variable. Bone integrity and bone marrow are not affected.

Histopathological findings in the intestinal sections describe a cystic enteropathy with enlarged crypts and reduction of the villi-crypt ratio with variable severity and shortening of the villi with clubbing formation in more severe cases. Severe lesions of the epithelial surface of the intestine cause malfunction of the digestion process and deficient nutrient absorption with the consequent impairment of other systems that require different nutrients for the normal growth and development of the chick.

CAUSAL AGENT

Multiple studies looking for the causal agent of this condition, including viruses, bacteria and parasites, have led to the identification of a group of viruses co-infecting the bird at a very early age, which act synergistically invading the enterocytes and causing severe damage to the intestinal epithelium.

VIRUS ISOLATION

Numerous viruses have been described and indirectly related to RSS, such as: reovirus, enterovirus, astrovirus, arenavirus and rotavirus. Attempts to isolate the causal agents have had limited success, until recently after persistent efforts in Dr. John K. Rosenberger’s laboratory (AviServe LLC, Delaware Technology Park, 1 Innovation Way, Suite 100, Newark, DE 19711 3USA) using different isolation and propagation systems and a challenge model to reproduce this condition.
For the process of virus isolation, samples of intestinal tissues are collected from affected chicks taking different sections of the intestine with its contents and they are homogenized, added antibiotics, freeze and thaw several times, centrifuged and filtered. The supernatant is used as the inoculum for cell culture inoculation and virus propagation attempts.

Virus isolations have been achieved from chickens and turkeys affected by this condition narrowing the search of the causal agents to a few orthoreoviruses and selected astroviruses. Similar viruses (Orthoreoviruses and astroviruses) have been isolated from 21 commercial broiler operations in 12 states of the USA and similar findings (Orthoreoviruses and astroviruses) have been isolated from turkey tissue samples obtained from 5 turkey commercial operations located in 5 states of the USA.

Serological characterization of the isolated chicken orthoreoviruses have shown two dominant serotypes. The orthoreoviruses isolated from turkeys appear to be more antigenically diverse than the chicken isolates but many are related to the chicken isolates. Multiple pathotypes have been observed among the orthoreoviruses. There is a very limited and transitory pathogenicity when these orthoreoviruses are inoculated via footpad.

Regarding the isolaton of avian astroviruses it appears to be a single serotype for chickens and turkeys. It is the most fastidious virus to isolate and propagate and it is more consistent regarding pathogenicity, being identified as a single pathotype. The virus may be vertically transmitted in chickens and turkeys.

Intracytoplasmic inclusion bodies of the orthoreoviruses have been observed in inoculated cell culture during virus propagation and these viral aggregates are demonstrated by transmission electron microscopy of thin tissue sections showing the viral inclusions in a paracrystalloid array in the cytoplasm of the infected cells. Similar intra-cytoplasmic inclusions have been observed in the cell culture used for astrovirus propagation and by electron microscopy.
CHALLENGE MODEL

In the design of the challenge model for orthoreoviruses and astroviruses, chicks and poults are selected for low or no maternal antibodies.

They are inoculated at one day of age by the oral and intra-tracheal routes with an approximate dose of $10^{3.5}$ TCID50. Birds are weighed, humanely euthanatized and necropsied at 2 to 3 day intervals for 2 to 3 weeks post-challenge. The gross lesions observed are recorded and tissue samples are collected for histopathological evaluation and virus re-isolation.

The results obtained after inoculation with the Orthoreoviruses or the astrovirus separately are compared with the non-inoculated controls and shown in tables 1 and 2.

<p>| TABLE 1. BROILER BODY WEIGHTS AT VARIOUS TIMES POST CHALLENGE AT 1 DAY WITH TWO DIFFERENT RSV VIRUS ISOLATES |
|---------------------------------------------------------------|---------------------------------------------------------------|</p>
<table>
<thead>
<tr>
<th>RSS VIRUS INOC.</th>
<th>MEAN BODY WEIGHTS IN GRAMS</th>
<th>RSS VIRUS INOC.</th>
<th>MEAN BODY WEIGHTS IN GRAMS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4 DAYS</td>
<td>6 DAYS</td>
<td>8 DAYS</td>
</tr>
<tr>
<td>NONE</td>
<td>134.7</td>
<td>189.1</td>
<td>250.2</td>
</tr>
<tr>
<td>GF ORTHOREOVIRUS</td>
<td>108.6</td>
<td>128.5</td>
<td>165.5</td>
</tr>
<tr>
<td>CP ASTROVIRUS</td>
<td>129.4</td>
<td>151.0</td>
<td>219.8</td>
</tr>
</tbody>
</table>

The mean body weight at day 13 post-challenge was markedly reduced in the group inoculated with the Orthoreovirus isolate in comparison with the astrovirus isolate and having a bigger difference when compared with the non-inoculated control group (Table 1).

Typical RSS lesions, including thinning of intestinal wall, paleness with constrictions with and without feed passage, were also more obvious in the orthoreovirus group in comparison with the astrovirus inoculated and the non-inoculated groups.
CONCLUSIONS

The experimental reproduction of RSS in chickens was demonstrated by inducing intestinal lesions similar to the disease in the field after inoculating separately orthoreovirus and astrovirus isolated from chicks affected with the cystic enteropathy.

Also observed were bursal and spleen atrophy and a rapid transmission of this condition to contact birds. Thymic atrophy varied with the virus inoculum and the age of exposure.

More severe lesions were observed with the “Dual” inoculation with both viruses (Orthoreovirus and astrovirus).
MANAGEMENT RECOMMENDATIONS

The following recommendations on the management system at the arrival of the day old chicks at the poultry farms may help to ameliorate the susceptibility of the chicks to the enteric infections with the field virus and to minimize the environmental load of the agents involved in inducing this condition:

- Uniform temperature of the house at chick placement and during early brooding: Warm litter (25°C) and house temperature (38°C)
- Ensuring feed consumption during the first 24 hours of chick placement (Full crop evaluation)
- Good ventilation to keep litter dry
- Balanced feed formulation with crumble presentation
- Sufficient extra feeders to have feed available to the reach of the chicks
- Water availability (25°C) with nipples at the eye level of the chick and low pressure
- Use of poultry houses which have had enough down time and proper decontamination / biosecurity measures.

ACKNOWLEDGEMENT

Photos and data presented in Tables 1 & 2 were obtained from Dr. John Rosenberger.
REFERENCES