Pathology of Spontaneous Hemorrhagic Enteritis of Turkeys

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ABSTRACT

Thirteen turkeys naturally affected with hemorrhagic enteritis were studied pathologically. The main gross lesions were splenomegaly and hemorrhagic contents in the gut. The main histological lesions were intranuclear inclusion bodies in large mononuclear cells in many visceral organs and in reticular cells around the sheathed arteries of the spleens and varying degrees of lymphocytic hyperplasia in most tissues. The inclusions were frequently present in areas of the lymphocytic hyperplasia. The large mononuclear cells with the inclusions frequently showed a degenerative change.

INTRODUCTION

Since Pomeroy and Fenstermacher (9) first described the condition of hemorrhagic enteritis in turkeys it has been reported as an important cause of mortality in many turkey producing areas (2, 4, 8). Descriptions of pathological changes in this disorder have focused on the intestinal tract (2, 4, 5, 8, 9) and spleen (2, 4). Recently, Itakura et al (6) reported that in birds experimentally infected with this disease the main histological lesions were intranuclear inclusion bodies and a lymphocytic reaction in many visceral organs. Morphological changes of organs other than the spleen and intestines have not been described in spontaneous cases affected with this disorder. This paper describes the lesions in several organs in turkeys naturally affected with hemorrhagic enteritis.

RÉSUMÉ

Cette étude portait sur la pathologie de 13 dindes souffrant d'entérite hémorragique naturelle. Les principales lésions macroscopiques se traduisirent par de la splénomégalie et un contenu intestinal hémorragique. Quant aux lésions histologiques, elles consistaient en des corps d'inclusion intra-nucléaires dont les auteurs notèrent la présence dans de grosses cellules mononucléaires, au sein de plusieurs organes, ainsi que dans des cellules réticulées, situées à la périphérie d'artères spléniqnes entourées d'une gaine. Ils observèrent aussi, dans plusieurs tissus, une hyperplasie lymphoïde plus ou moins intense. Les inclusions se situaient souvent dans des foyers d'hyperplasie lymphoïde. Plusieurs des grosses cellules mononucléaires, porteuses de corps d'inclusion, présentaient de la dégénérescence.

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MATERIALS AND METHODS

Materials used in this investigation consisted of 13 moribund or dead turkeys as shown in Table I. They were collected from three turkey farms (A, B and C) in southern Ontario in October, 1973. Although they could not be examined in detail by the authors the observations by the flock owners regarding the incidence and clinical signs of affected turkeys appeared to be the same as the findings, depression, sudden death and bloody droppings described by Pomeroy (8).

Following post mortem examination portions of liver, spleen, intestines, bone marrow, bursa of Fabricius, lungs, proventriculus, esophagus, crop, pancreas, testis, kidneys, skeletal muscle, gizzard and brain were collected, fixed in 10% buffered formalin and embedded in paraffin. Sections were stained with hematoxylin and eosin.

RESULTS

MACROSCOPIC FINDINGS

All the turkeys were in good flesh but pale. In some the feathers around the vent were soiled with dark-coloured feces. The spleens were one and a half to four times normal size, soft and dark red in colour with predominant numerous white pulp.

The duodenum and anterior half of the jejunum in many specimens were distended and contained red to green mucinous material. The mucosa of these portions showed swelling and multiple petechial hemorrhages sometimes with small necrotic areas and rarely small ulcerations. The other parts of the small intestines and the large intestines showed swelling, occasionally with petechial hemorrhages. The cecal ton-
sils were frequently enlarged, sometimes with petechial hemorrhages and necrosis. The lungs were congested. The livers, kidneys and bone marrows were generally pale in colour. Petechial hemorrhages were rarely observed in some of the skeletal muscles.

**Microscopic Findings**

**Liver** — The livers were slightly congested. Endothelial cells of the sinusoids were increased in number, frequently swollen and revealed engulfed hemosiderin. A few medium sized lymphoid cells and heterophils were scattered in the sinusoids. In many cases, intralobular cell nodules consisting of medium-sized lymphoid cells and swollen endothelial or large mononuclear cells were occasionally observed. Small areas of coagulation necrosis were scattered in the liver parenchyma of five cases. This lesion was well demarcated from the surrounding tissue and frequently associated with a few swollen endothelial cells and heterophils. Small aggregations of medium-sized to large lymphoid cells were present in the interlobular connective tissue in a few cases.

A few large mononuclear cells containing intranuclear inclusion bodies were found in the sinusoids (Fig. 1), intralobular cell nodules (Fig. 2) and the lymphoid cellular aggregations in the intralobular connective tissues. The cells containing the inclusion were large in size, some as large as free macrophages, round to irregular in shape and rich in a basophilic cytoplasm. Their nuclei also were large and round to irregular in shape in concert with the cytoplasmic dimensions. The nuclear membrane was sometimes hyperchromatic and the nucleolus appeared displaced and attached to the membrane. The inclusion occupied most of the nucleus and were stained pale pink to pale purple, frequently containing many minute pale red granules. In addition, such cells frequently appeared to be degenerating. They were smaller in size, more irregular in shape and showed eosinophilia of the cytoplasm and granulation of the nuclear membrane. The inclusions in these cells were stained more eosinophilic.

**Spleen** — The white pulp was slightly enlarged, frequently containing large lymphoid cells but inclusion bodies were not found in that area. The red pulp was frequently congested. Swollen reticular cells

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**TABLE I. Distribution of Intranuclear Inclusion Bodies**

- **Distribution of Inclusion Bodies**
  - Bone marrow
  - Lungs
  - Heart
  - Pancreas
  - Liver
  - Spleen
  - Testis
  - Kidneys

- **Termination Liver Spleen**
  - Terminated dead
  - Terminated killed

- **Case Age (weeks)**
  - Turkey
  - Farm No.

- **Sex**
  - Male
  - Female

- **Symbols show the number of inclusion bodies observed in one histological section. + a few, ++ a comparatively large number, – not observed.**

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mainly that of the villi of the duodenum, jejunum and some cecal tonsils. The severe hemorrhages were occasionally associated with necrosis of the tips of the villi. Varying degrees of lymphocytic hyperplasia occurred often in the lamina propria of all parts of the intestines including cecal tonsils. The hyperplasia was frequently accompanied by an increase of large lymphoid cells, plasma cells and heterophils. Some germinal follicles were formed in the areas showing severe lymphocytic hyperplasia (Fig. 5). Reticular cells of the lamina propria were occasionally swollen and had engulfed hemosiderin. The same inclusions as seen in the liver were scattered in large mononuclear cells of the lamina propria of all parts of the intestines but appeared to be more numerous in areas showing severe lymphocytic hyperplasia and in the cecal tonsils (Fig. 4).

**Bone marrow** — Heterophil myelocytes and heterophil leukocytes were increased in number. An increase of lymphocytes with

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Fig. 3. Spleen. Proliferation of reticular cells around a sheathed artery, some of which are markedly swollen with intranuclear inclusion body. There is hyperplasia of lymphoid cells and plasma cells around the artery. Case No. 9. H&E. X903.

Fig. 4. Lamina propria of cecum. Hyperplasia of lymphocytes consisting mainly of medium-sized to large cells. Two large mononuclear cells have intranuclear inclusion body (arrows). The upper cell indicated by arrow appears degenerate. Case No. 11. H&E. X781.
nodule formation was present in some of the sections. Several mononuclear cells containing the inclusions were found in the areas of lymphocytic accumulation. Their features were identical with those in the liver.

**Lungs** — The lungs were congested. An occasional heterophil was observed in the alveolar walls. Circumscribed small accumulations of lymphocytes were scattered in the walls of the stem bronchi of a few cases. The same inclusions as seen in the liver were rarely but clearly present in large mononuclear cells of the alveolar walls.

**Proventriculus, esophagus and crop** — Areas of slight lymphocytic hyperplasia with a few large lymphoid cells were scattered in the lymphoid tissues in the lamina propria of a few cases. The inclusions identical with those of the liver were rarely present in large mononuclear cells of the lymphoid tissues.

**Bursa of Fabricius** — In the medulla of the lymphoid follicles of several cases there were a few large mononuclear cells with the same inclusions as seen in the liver. An exudation of a proteinic fluid into the medulla was observed in three cases.

**Kidneys, pancreas and testis** — Circumscribed accumulations of lymphocytes, sometimes with large lymphoid cells were observed in the interstitial connective tissue of each organ. Several large mononuclear cells in these cellular aggregations had the inclusions identical with those of the liver.

**Other organs** — Significant lesions were not observed in other organs. The thymus was not examined.

The wide distribution of the intranuclear inclusion bodies in various organs is shown in Table I.

**DISCUSSION**

From the results obtained in this study it appears that the main histological lesions of hemorrhagic enteritis are intranuclear inclusion bodies and lymphocytic hyperplasia in almost all tissues except the central nervous system.

It has been demonstrated by electron microscopy that the inclusions probably have an adenovirus component (2, 7). However, the cells containing the inclusions were not identified (2) before Itakura and Carlson (7) suggested from the electron microscopic findings that they occurred in two types, reticular cells and their immature cells. In the present study the inclusions were also found in two types, large mononuclear cells in many visceral organs and reticular cells around the sheathed arteries in the spleen. The former seemed to show the features of an immature type of the cell. The cells containing the inclusions occurred in tissue areas of the reticuloendothelial system. These findings support that the large mononuclear cells may result from the reticuloendothelial system.
Sometimes degenerative changes were observed in the large mononuclear cells with the inclusions. Gross and Domerumth [Proc. 44th Meeting of the Northeastern Conference on Avian Diseases (1972)] stated that there were many large “signet ring” shaped nuclei containing light acidophilic inclusions and many other nuclei had smaller inclusions. In addition it has been shown that the cells with the inclusions showed a degenerative process in the electron microscopic examination (7).

As stated in the present authors’ previous report (6), it is probable that the other main lesion, the lymphocytic hyperplasia of this condition, is not a pathognomonic feature but a general response to the viral infection. However, it is interesting from the standpoint of an infectious theory for this disease that there was a frequent correlation between the presence of the inclusions and lymphocytic hyperplasia in the tissues. The lymphocytic hyperplasia developed in the early stages of infection as evidenced by the frequent occurrence of large lymphoid cells. On the other hand, the inclusions were most numerous in the central lymphoid organs such as spleens, cecal tonsils and the connective tissue which has a high potentiality for producing lymphoid tissue. The reason why the inclusions were very rare in the bursa of Fabricius, one of the central lymphoid organs, can not be explained.

Enteritis with hemorrhages were frequent but not always constant in this condition. On the other hand, splenomegaly was a consistent lesion. The same results were obtained in birds experimentally infected with this disease (6). Therefore, splenomegaly should be noticed as one of the gross lesions in this condition. The marble spleen disease of pheasants is characterized by splenomegaly (1, 3, 10). In this disease intranuclear inclusion bodies are formed in the reticular type cells of the spleen (1, 3, 10), liver, lungs and proventriculus (8). The structures of these cells with their inclusions and adenovirus-like particles demonstrated by electron microscopy (3) appear very similar to those of hemorrhagic enteritis of turkeys. The relationship between both diseases should be studied etiologically in future.

REFERENCES