Pathomorphological investigations on the incidence of chronic liver lesions and their association with welfare in White Pekin ducks

I. DINEV*, K. KOEV2, M. LUTZKANOV2

1Department of General and Clinical Pathology, Faculty of Veterinary Medicine, Trakia University, Student’s Campus, 6000 Stara Zagora, BULGARIA.
2Department of Microbiology, Infectious and Parasitic Diseases, Faculty of Veterinary Medicine, Trakia University, Student’s Campus, 6000 Stara Zagora, BULGARIA.

*Corresponding author: idinevnz@mail.bg

SUMMARY

Pathomorphological investigations were carried out in a flock of 7150 White Pekin ducks (Anas platyrhynchos domestica) at the age of 51–68 weeks. Morbidity and mortality rates were determined. The overall mortality during the 18-week period of the study was 710 (9.93%) ducks. Eighty five carcasses referred in groups of 7-10 at 2-week intervals were submitted to gross anatomy examinations and macroscopic lesions were described. Microscopic lesions were detected in 68 (80%) of 85 liver samples. Lesions specific for amyloidosis and cirrhosis – in 14 (16.47%) cases and 6 samples (7.05%) exhibited neoplastic growths classified as cholangiomas. According to these results, amyloidosis was identified as the most frequent cause of morbidity due to chronic liver lesions in White Pekin ducks, followed by amyloidosis associated with cirrhosis and last but not least, cholangioma.

Keywords: White Pekin duck, amyloidosis, cirrhosis, cholangioma, ascites.

Introduction

A review on the prevalence of subacute and chronic liver lesions in White Pekin ducks has been made more than five decades ago [5]. The authors have determined the findings of gross anatomy and histopathological changes on 82 breeder flocks in the region of New York as chronic hepatic disease. In this nosological entity, they include three main categories: amyloidosis (most common in ducks older than 10 weeks), perihepatitis with or without ascites (most common at the age of 2-10 weeks) and cirrhosis, observed only in 3 cases: 2 ducklings at the age of 22 days and 1 duck at the age of 14 months.

Avian amyloidosis is a well known pathological disorder affecting a great variety of species and occurring in association with a number of diseases, mostly chronic infections. The first description of avian amyloidosis is made in a pheasant by Röll in 1867 [7].

Regardless of the circumstance that amyloidosis has been encountered in numerous bird species, the highest recorded incidence was that in anseriforms. Anatidae are exceptionally susceptible to the development of amyloidosis. In a study made in Japan with 88 birds from the family Anatidae, 77% of postmortally examined Anatinae (ducks) and 51% of Anserinae (swans and geese) have suffered from generalized amyloidosis [21].

Amyloid is an eosinophilic, homogeneous, hyaline substance that is extracellularly deposited and originates from protein precursors [15]. Among more than 15 biochemical types amyloid acknowledged in mammals [4], only amyloid A (AA) has been detected in birds [10, 15]. The birds are susceptible to amyloidosis at any age, but the condition is most commonly seen in adults, although described in 4-week-old ducklings [22].

Depending on the pattern of amyloid deposition, two type of amyloidosis are observed in birds: systemic and amyloid arthropathy. Brown stock layers are believed to be especially prone to the second type [11, 12].

Similarly to wild Anatinae, the systemic amyloidosis A is an unusual pathological disorder in domestic ducks. There are
however species-related differences in the susceptibility to amyloidosis: Kaiya (Anas platyrhynchos variant domestica) and Chinese ducks are susceptible to amyloidosis but Muscovy ducks are not [13]. Amyloidosis in Pekin ducks has become important as a model for amyloid research [17, 18, 20] since the first epidemiological report by RAKHMANOV [16], testifying about a 45% prevalence among intensively reared ducks. The spontaneous distribution of amyloidosis among Pekin ducks increased with age, similarly to wild caged birds and has been associated to chronic infectious diseases [19, 20]. Amyloidosis was also related to clinical ascites and foot oedema in White Pekin ducks [6].

A detailed histological description of amyloidosis in ducks is provided by several authors [14, 18, 21].

DOUGHERTY & RICKARD [5] concluded that amyloidosis was the commonest and the most important liver diseases in ducks. Perihepatitis, the lesion next in frequency, is thought to be independent from amyloidosis although adult ducks having suffered from amyloidosis exhibited both lesions at a time. The cases of perihepatitis and cirrhosis in the view of authors were probably related to infection (R. anatipestifer infection or viral hepatitis), although no agents have been isolated in these cases.

The purpose of the present study was, by means of pathomorphology, to determine the incidence of chronic liver lesions as a cause of morbidity in breeder White Pekin duck flocks.

Materials and Methods

Pathomorphological investigations were performed in a breeder flock of 7150 White Pekin ducks at the age of 51–68, corresponding to the beginning of egg-laying resumed after a forced 3-month cessation. Morbidity and mortality rates were determined. Eighty five carcasses referred in groups of 7-10 at 2-week intervals were submitted to gross anatomy examinations and macroscopic lesions were described. For histological studies, samples of visceral organs (liver, spleen, kidneys, pancreas, small intestine, duodenum and jejunum) were obtained from 27 carcasses. Materials were fixed in 10% neutral formalin for 48 h, processed by routine histological techniques and embedded in paraffin. Cross sections were stained by haematoxylin/eosin (H/E), Congo red, Heidenhain’s azan trichrome and Masson-Goldner staining kit (Merck). A set of 4 visceral organs (heart, spleen, liver) samples was taken from each series for bacteriological study using conventional methods.

Results

About a month after the beginning of lay after the molting period, the daily mortality rate in the flock has increased compared to the usual rates for this category of domestic fowl. The data for the week and total mortality rates during the period of the study are presented on Fig. 1. The week mortality was on average 40 birds (0.55%), varying between 25 (0.35%) and 52 (0.72%) ducks. The total mortality throughout the 18-week period reached 710 ducks (9.93%). The average daily egg-laying rate was by 5-6% lower compared to technological norms. Usually, the bodies of dead ducks were detected during the morning flock visit without any previous obvious clinical signs, except for apathy or anorexia in single cases.

Microscopic lesions were detected in 68 (80%) of the 85 liver samples studied. In 48 of them (56.48%) lesions specific for amyloidosis were found out, in 14 samples (16.47%) the lesions were at a time specific for amyloidosis and cirrhosis, and in 6 cases (7.05%) there were neoplastic growths determined as cholangiomas. In the rest 17 (20%) liver samples there were not specific alterations with the exception of weak to moderate fatty degeneration or venous hyperaemia in single cases.

Macroscopically, amyloidosis was characterized with a variously enlarged, dense or hard, with light brown to light yellow liver. More than half birds (25 or 52%) with amyloidosis, showed also a marked ascites. The palpation of abdominal walls revealed a fluctuation, which was found to be due to a considerable amount of opaque yellowish fluid in the pleuropertitoneal cavity (Fig. 2).

In cases with gross anatomy signs of cirrhosis, the liver was embedded by a thick, diffuse fibrous tissue overgrowth of a grey-whitish colour. The cut surface was waxy, and the liver capsule was markedly thickened due to fibrosis (Fig. 3). All cases of cirrhosis were accompanied by ascites – the abdominal cavity was filled with clear straw-yellow fluid.

In ducks whose hepatic lesions were classified as cholangiomas, neoplasms appeared as compact grey-whitish nodes protruding to liver surface, of a size from 1–2 to 3–4 cm in diameter. The cut surface of the growth exhibited multiple cyst-like cavities filled with yellow-brownish fluid and surrounded by a connective tissue capsule (Fig. 4).

Histologically, amyloidosis was accompanied by deposition of vast paths of homogeneous substance in perisinusoidal spaces of the liver, that, in some instances, compressed but not obliterated the sinusoidal capillaries. Amyloid was stained well with eosin, but was demonstrated by Congo red staining as well (Fig. 5) as brown-orange findings. Vast paths of thick connective tissue under the capsule that entwined among

![Figure 1](image-url): Average weekly mortality at the age of 51-68 weeks.
islets of intact liver tissue of a various size were present (Fig. 6). At some loci, cicatrized tissue masses contained disintegrated epithelial elements and bile epithelial cells. The connective tissue began from the portal areas or infiltrated the adjacent epithelium from surrounding outlet veins.

Severe amyloid deposits were also observed in the other studied organs: spleen, pancreas and small intestine.

The histological structure of neoplastic growths classified as cholangiomas consisted of well differentiated formations resembling bile ducts, some of them anastomizing and filled with secretion (Fig. 7).

In five samples designed for bacteriological examination which were taken from ducks having both amyloidosis and ascites E. coli was isolated. The other samples were sterile.

**Discussion**

According to the results obtained in the present study, amyloidosis was found to be the predominant chronic liver lesion in White Pekin ducks. These findings correspond to the results of DOUGHERTY & RICKARD [5] dating back more than 45 years. We also share the the expressed by authors opinion that the incidence of amyloidosis usually increases with advancing the age due to the tendency towards chronic pathologies at that time [21]. In this survey we have not attempted to elucidate the etiological factor but we believe that the disease is encountered in species, poorly adapted to farm conditions and therefore, susceptible to stressors [8, 9]. In our study, such factor was probably the beginning of egg laying after the molting period. This assumption is supported by the statements for lack of amyloidosis in freely living ducks.
birds [1]. Also, the disease was found to be induced by psychosocial stress with prevalence related rather to the social group size than to the space available to the bird [3].

We could not comment on the influence of sex on the incidence of amyloidosis as our observations were only on White Pekin ducks [21] but there was no cases of amyloidosis among male Muscovy ducks (Cairina moschata) living in the same farm. The cases observed during the autumn and winter in this study confirmed the seasonal peak reported in the Anseriformes order [9, 23].

The incidence of ascites associated with amyloidosis in this study (52%) was considerably higher than that (14%) reported by DOUGHERTY et al. [5]. In our point of view, ascites was related to circulatory disorders due to liver diseases, but we found no foot oedema as reported in another investigation [17].

The cases exhibiting both liver amyloidosis and cirrhosis (16.47%) made us to believe that these conditions were interrelated but not independent as reported by Dougherty et al. [5]. In our view, cirrhosis occurred as a secondary late lesion in older birds that have suffered amyloidosis. This suggestion is supported by the high incidence of cirrhosis in our study (16.47%), compared to the lower prevalence (5.67%) in the quoted survey [5], where cirrhosis was etiologically associated to infectious hepatitis.

The incidence of cholangioma among liver lesions in our study was the lowest (7.05%). Nevertheless, the significance of this lesion should not be underestimated although it is difficult to make any comparison as this lesion type is usually encountered sporadically [2].

To conclude, according to the present survey, amyloidosis was the most frequent cause of morbidity due to chronic liver lesions in White Pekin ducks, followed by amyloidosis associated with cirrhosis and last but not least, cholangioma.

References


