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Pancreatic lesions under different pathological conditions and its correlation with poultry diseases

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Abstract

Pancreas is a unique organ due to its endocrine and exocrine function which plays a pivotal role in the food digestion as well as metabolism of glucose for energy generation. Pancreatic malfunctioning may affect the basal metabolic rate and have significant impact on body weight in the poultry. The present study evaluates the various lesions under different pathological conditions and its correlation with various poultry diseases. An aggregate of 240 samples of pancreas were collected from chickens affected with diseases of viral, bacterial, protozoal, fungal, metabolic, and toxicological origin. The birds under the present study were categorized on the basis on age (0-2 weeks, 2-4 weeks and above 4 weeks) and the diseases were confirmed on the basis of flock history, sign, symptoms and necropsy lesions. The gross lesions observed in the pancreas were bleached, atrophied, congested, deformed and mottled with necrotic foci, however, few lesions were hyperplastic. The gross lesions were more evident for bacterial diseases as compared to viral diseases. The histological lesions observed in the pancreas included interstitial fibrosis, congestion, diffuse pancreatic fat necrosis, individualization of acinar cells distended zymogen granules and thickened capsule. Acinar components were more affected than that of islets of Langerhans. Therefore, it was concluded that pathological alteration in the pancreas of the Vanaraja and Chabro breeds of poultry were more common in metabolic diseases as compared to other infectious diseases.

Keywords: Pancreas, histochemistry, hyperplastic, metabolic diseases and bleached

Introduction

Pancreas is unique in its functions, both as an exocrine and endocrine organ as well. While the exocrine pancreas secretes digestive enzymes into the duodenum, the endocrine pancreas is composed of the islets of Langerhans, which contain specialized hormone-secreting cells. These cells include α cells, β -cells, δ -cells, and γ -cells, which secrete glucagon, insulin, somatostatin, and pancreatic polypeptide, respectively. The endocrine pancreas plays a critical role in regulating glucose homeostasis. Birds displays the highest fasting blood glucose concentration among all vertebrates, with concentrations that are more than twice those in mammals (Al-Haaik 2018) [1]. Pancreatic deformities like curving of duodenal loop (J-like appearance) and pancreatic atrophy, has been reported during Postmortem examinations of broiler chicken infected with parvovirus (Nunez *et al.*, 2016) [8] and zinc toxicosis in ostrich as well. It was also found that major histological lesions were acute pancreatic necrosis and their atrophy due to different strain of influenza viruses in duck (Brojer *et al.*, 2009) [5], swan (*Cygnus cygnus*) (Teifke *et al.*, 2007) [15] and chicks (Shinya *et al.*, 1995) [14]. Nakamura *et al.*, (2002) [7] reported pancreatic multifocal necrosis in pancreatic acinar cells in adenovirus-associated hydro pericardium syndrome (Leechi Heart Diseases) of broiler chicken. Pancreatic Adenocarcinoma has been evidenced in guinea fowl and chicken by Abdul-Aziz (1995) [2] respectively. The present study evaluates the various pancreatic lesions under different pathological conditions and its correlation with various poultry diseases.

Materials and Methods

The present study was conducted on the pancreas of 240 dead poultry birds (Chabro and Vanaraja) during the post-mortem examinations conducted at the Department of Veterinary Pathology, Bihar Veterinary College Patna, Bihar Animal Science University Patna. The information with regard to age, breeds weight, types of feed, clinical signs and vaccination etc. were collected. All precautionary measures were taken to protect our self and environment from infective diseases, if any. The dead bird were subjected to thorough necropsy as early as

possible. All the three lobes of pancreas were examined carefully of any gross pathological lesions. In addition, the pathological lesions of significance if present in any of the organ system were recorded for the sake of tentative diagnosis of the disease condition where ever required bacteriological or serological or pathological examination were carried out for conformation of the disease conditions. Irrespective of age, sex and breeds, chronic disease conditions are characterized by significant loss of sternal and thigh muscles volume, relatively low bodyweight and atrophic organs of the body specially heart and liver.

Results and Discussion

Post-mortem examination of diseased birds revealed remarkable gross pancreatic lesions in the birds. The diseased pancreases exhibited congestion, bleached and mottled appearance with multifocal necrotic lesions. In the present study, the major gross pathological changes comprises bleached & mottled appearance, pancreatic congestion, deformities, atrophy and hyperplasia which are shown in the given figure. Somewhat similar description of gross pancreatic pathology has also been reported by Majumdar *et al.*, 1997^[9] and Klar *et al.*, 1990^[6].

The highest incidence among the gross pancreatic lesions, were recorded for bleached (33.33% in Chabro and 23.07% in Vanraja) & congested appearance (almost 19% in both the breeds of poultry) shown in figure-1 and 2. Similar findings of bleached appearance of diseased pancreas as a major gross pathological lesion has also been reported by Ruff, 1987 and Qamar *et al.*, 2013^[11]. Mottling of pancreas due to small pinpoint nodular or non- nodular appearance of multifocal necrosis was found to be a consistent feature in diseased pancreas. Mottling of pancreases shown in figure-3, was easily detectable at the time of necropsy in Vanraja (15.23%) and Chabro (09.52%) breeds of poultry. It was also reported by Wallner-Pendleton *et al.* (1993)^[16] in a spontaneous case of diabetes mellitus in red-tailed hawk (*Buteo jamaicensis*) and it may be due to markedly vacuolated islet cells which had been histochemically proven to be beta cells of endocrine glands of pancreas. Another feature of pancreatic pathology which is its deformity (figure-4) was frequently found in different age groups of Vanraja (11.50%) and Chabro (19.04%) breeds of poultry. Pancreatic deformities ranged from simple bending of terminal pancreas along with duodenal loop to complex twisting of duodenal pancreatic complex often assuming the features of torsion. Further, these pancreatic deformity in the majority of cases affects the terminal part of duodenal loop. The deformity were found to be more frequent in Chabro breeds as compared with Vanraja breeds of birds. Pancreatic deformities may be attributed to stronger connective tissue stroma and more proliferation of fibrous connective tissue with aging of the birds. Nunez *et al.*, 2016^[8] also reported curving of duodenal loop (J-like appearance), pancreatic atrophy, and mesenteritis during Postmortem examinations of broiler chicken infected with parvovirus (figure-5 and 6).

It is a well-established fact that avian exocrine pancreas has poor intra-acinar and intralobular connective tissue framework (Aziz and Fletcher, 2016)^[3]. The resisting and proliferating nature of developing and regenerating exocrine pancreatic tissue may lead to distortion in the shape of pancreas which bring about concomitant spontaneous twisting of duodenal loop matching each and every curve being

developed in diseased pancreas. This was proven during necropsy as the pancreatic tissue showed deformity in conformity with the twisted appearance of duodenal pancreatic complex.

Pancreatic deformity has the potential to bring obstructive changes in pancreatic duct and blood supply which may interfere with secretory function of exocrine pancreas. Congestion has also been a consistent change in pancreatic parenchyma in the present study. All these points are clearly indicative of abnormal pancreatic function, mainly exocrine segment in the affected birds thereby directly or indirectly responsible for poor body weight gain due to improper digestive and absorptive processes in local poultry breeds. The highest incidence of pancreatic deformities were observed in chick edema disease (56% in Vanraja & 54% in chabro birds) and colisepticemia (51.3% in Vanraja & 42% in chabro birds). Both of these conditions mainly affect growing birds and are associated with increased intra-abdominal pressure due to accumulation of fluid or exudate. Such pathological conditions are slow developing and provide ample opportunity for growth of fibrous connective tissue and passive hyperaemia. Fibrosis of pancreatic parenchyma may interfere with secretory functions of pancreas. Corroborating all these findings are corroborating, with similar findings of Renu *et al* (2020)^[12], Mundhenk *et al.*, 2009^[10] and Nunez *et al.*, (2016)^[8]. Hence, it is obvious that pancreas suffer major pathological change and plays an important role in the deranged physiology of the digestive system.

Bleached appearance of pancreas was most prominently seen in coccidiosis (83% in Vanaraja & 32% in chabro birds), ascariasis (66% in both breeds of birds), fowl pox (almost 66% in both breeds of birds), IBD (55.50% in Vanaraja & 46.00% in Chabro birds) and nephrosis(53% in Vanaraja & 45% in Chabro birds). Anaemia is the consistent findings among the aforesaid diseases which may constitute an important underlying factor in giving bleached appearance to pancreas. Congestion of pancreas in Vanaraja and Chabro breeds of poultry was a consistent pathological features of various viral, bacterial, parasitological, metabolic and toxicological poultry diseases in the present study. Acute pancreatitis which is an inflammatory disease of the pancreas could be a probable reason behind the congestion of pancreas. The most common cause of acute pancreatitis is obstruction of the distal common bile-pancreatic duct. We hypothesize that acute biliary pancreatitis and other causes of acute pancreatitis possess a common pathogenesis.

Atrophic changes in the pancreatic parenchyma were not a consistent finding and considered as a minor pathological change characterized by shrunken white pancreas giving lesser gross visibility of the organ during necropsy. It was most evident in cases of adult Vanaraja (33.33%) and Chabro (23.00%) breeds of poultry suffering from fowl pox. Nunez *et al* (2016)^[8] also found the pancreatic atrophy and curving of the duodenal loop (J-like appearance) in the chickens screened for avian nephritis virus (ANV), chicken astrovirus (CAstV), avian rotavirus (ArtV), avian reovirus (AReoV), infectious bronchitis virus (IBV), fowl adenovirus group I (FAdV-1), and chicken parvovirus (ChPV). On the other hand, pancreatic atrophy and atrophy of acinar cell is characteristically seen when the bird is subjected to dietary deficiency of protein and energy.

Thus, it is evident from the finding of gross pathological changes in pancreas under different disease conditions that the

changes recorded are non-specific in nature, rather these are manifestations of secondary pancreatic involvement. None of the gross lesions could be taken as a change of diagnostic significance; however, their presence is a clear indication of pancreatic dysfunction.



Fig 1: Bleached appearance of pancreas with mild end segmental deviation. (Vanaraja)



Fig 2: Congested and acutely folded duodenum pancreatic loop in Chabro poultry bird



Fig 3: Folding and mottling of duodenopancreatic complex. (Vanaraja)



Fig 4: Marked shortening of pancreas due to atrophy, in Vanaraja poultry bird



Fig 5: Mid-segmental curving of duodeno pancreatic complex with congested. (Chabro)



Fig 6: Curving of duodenum with bleached appearance of pancreas. (Chabro)

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