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Pathomorphology of Acute Duck Cholera Infection in Meat Ducks

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ABSTRACT

Background: Duck farming is one of the major income generating enterprise, promoting rural economy in India. The occurrence of infectious diseases is the major bottle neck in the profit generation process of duck rearing. Duck cholera is one of the major bacterial infections, commonly noticed in 4 to 11 weeks age of egg laying ducks caused by *Pasteurella multocida*, leading to high mortality in ducklings whereas adult as well as meat type ducks are resistant. The present communication describes pathomorphology of acute duck cholera in Vigova Super M meat type breeder flock.

Methods: An investigation was carried out to ascertain the possible cause of increased mortality in an intensively maintained 1000 Vigova Super M meat type breeder flock of 25 week old during the month of July 2023. Necropsy examination conducted on five dead birds and samples collected and subjected for bacteriological and pathological examination.

Result: Affected breeder duck flocks showed cumulative mortality of 18 per cent. Clinical signs of depression, inappetance, mild conjunctivitis and mucus discharge from nostril for one or two days followed by death were noticed. At necropsy, hepatomegaly and splenomegaly with multifocal cream-colored foci randomly distributed throughout the parenchyma, vascular changes in various visceral organs were noticed. Impression smear of visceral organs of dead birds revealed bipolar organisms which was confirmed as *Pasteurella multocida* by cultural and biochemical examination. Microscopically, there was multifocal splenic and hepatic necrosis with intralesional rod-shaped bacteria. In conclusion, this investigation indicated that the adult breeder ducks susceptible to duck cholera, exhibiting pathomorphological features similar to young ducklings.

Key words: Duck cholera, Meat duck, *Pasteurella multocida*, Pathology.

INTRODUCTION

Ducks constitute a major component of the poultry industry throughout the world. In India, the 20th Livestock Census identified 33.51 million ducks, which was 23.53 million during the 19th Census (DAHD, 2019). The substantial increase (42.3%) in duck population indicates high demand for duck farming. Like chicken, ducks are reared for eggs and meat. Vigova Super M (Super Meat) is a broiler strain of duck which is a cross of White Pekin and Aylesbury and has its origin in Vietnam. They have high disease resistance, faster growth rate and good feed conversion efficiency. These are ideally suited for the Indian climate and are gaining popularity in India. Information on the prevalence of duck disease especially in meat ducks is very scanty (Bhattacharya, 2005) even though it often tends to bring great economic loss to the farmers.

Infectious diseases are considered as one of the most important causes of economic loss in duck farming. Duck plague (Duck Viral Enteritis), Duck Cholera (Pasteurellosis) and Duck Viral Hepatitis are commonly encountered infectious diseases in duck flocks (Panickan *et al.,* 2021) . Duck cholera (FC) is a highly contagious bacterial diseases caused by *Pasturella multocida* (*P. multocida*) and remains as constant threat to duck industry because of the prevalence of *P. multocida* carriers in healthy duck flocks (as high as 63 per cent), mortality (may reach 50 per cent) and low productivity of egg and meat both in domestic and wild water fowl (Baki *et al.,* 1991; Kumar *et al.,* 2004). Hence it is essential to have a proper surveillance and monitoring of this disease to take appropriate precautionary measures such as vaccination, better health management practices and also other farm related biosecurity procedures to avoid infections. In ducks age susceptibility to *P. multocida* infection peaks between 4 and 11 weeks whereas older birds as well as meat type ducks are less vulnerable (Hunter and Wobeser, 1980), hence, the occurrence of duck cholera in adult and meat type ducks has been reported rarely. The purpose of the present communication is to

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document the pathomorphological features of naturally occurring duck cholera in Vigova Super M meat breeder flock.

MATERIALS AND METHODS

Vigova Super M meat duck flock of 1000 birds was maintained for breeding in commercial farm at Karur District of Tamil Nadu. The flock age was 25 week old, fed with commercially prepared feed and maintained under intensive rearing system. The birds were recently shifted from grower shed to breeder shed which were located 75 km apart. After a week of shifting, the flock experienced persistent mortality of 5 to 7 birds per day with a cumulative mortality of 18 per cent inspite of antibiotic treatment as per the advice of Veterinarian. Birds were previously vaccinated against duck viral enteritis and Duck viral hepatitis.

Necropsy and histopathological examination

Dead birds presented for postmortem examination to Poultry disease diagnosis and Surveillance Laboratory, Veterinary College and Research Institute, Namakkal during the month of July 2023. Necropsies were performed as per approved procedure. After external and internal examination of tissues and organs individually for gross lesions, materials for histopathology were collected from heart, lung, liver and spleen and fixed in 10% neutral buffered formalin. After fixation, samples were embedded in paraffin, sectioned at 5 μm thickness and stained with hematoxylin and eosin for histopathological examination.

Isolation of causative agent

Impression smears of spleen, liver and lung were collected from dead birds and stained with Leishman stain. Heart blood swab and tissue pieces from lung, liver and spleen collected from dead birds were subjected to bacterial isolation and identification. The heart blood swab and tissue samples were inoculated into Brain Heart Infusion (BHI) broth and incubated at 37°C overnight and the broth culture was streaked onto blood agar and Mac Conkey agar. The colonies suggestive of *P.multocida* were subjected to biochemical tests for identification. The biochemical tests included IMVIC, sugar fermentation test and catalase and oxidase test (Quinn *et al.,* 1994).

RESUITS AND DISCUSSION

In the present study, mortality of Vigova Super M meat ducks within 24 to 48 hrs after exhibiting clinical signs of dullness, depression, mild conjunctivities and mucus nasal discharge were suggestive of duck cholera infection (Islam *et al.,* 2003). Death of ducks in acute fowl cholera might be caused by endotoxic shock (Park, 1982; Lee *et al.,* 1992). However, Hossain *et al.* (1999) suggested that the neural degeneration, cardiomyopathy, severe pneumonia, extensive lesions in liver, blood loss due to haemorrhage, dehydration and inanition alone or in combination may have also contributed to the clinical manifestations and death of birds. The infection is characterized by rapid onset and high mortality rate, as observed in the present study. Field outbreaks of avian cholera in waterfowl are characterized by acute to peracute mortality and chronic disease has not been a reported feature of epornitics. In the present study cumulative mortality of 18 per cent was concurrence with Das *et al.* (1991) who recorded 19.5 per cent mortality during an outbreak of duck cholera in an organized farm. Increased mortality in duck flock was noticed after shifting of birds from grower to layer shed which is corroborated with the findings of Christensen and Bisgaard (2000) who reported that the clinical disease is precipitated by stress such as overcrowding, laying and severe climatic change.

On necropsy examination, all the dead birds showed similar type of lesions with varied severity. Carcasses were good in body condition with generalized congestion. Heart showed petechial to ecchymotic (Fig 1) and even suffusive haemorrhages (Fig 4) on epicardial and endocardial

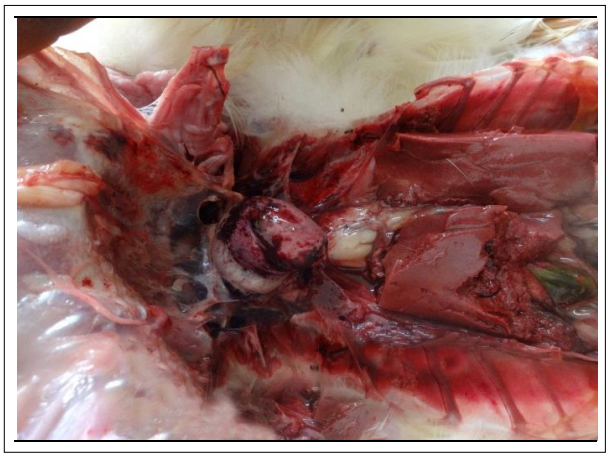

Fig 1: Heart showing petechiae to ecchymotic haemorrhages on epicardial surface.

Fig 2: Spleen enlarged with mottled appearance due to multiple greyish white necrotic foci.

surfaces. In few birds pericardial sac contained serous fluid. Lungs were edematous, congested with petechial heamorrhages (Fig 4). Tracheal lumen contained mucus exudate with mild congestion. Spleen was enlarged with multiple greyish white foci (Fig 2). Petechia to ecchymotic haemorrhages were observed on abdominal fat and intestinal serosa. The small intestine was found hyperemic and congested with excess mucus exudate, whereas large intestine was devoid of these changes. Liver was enlarged with multiple necrotic foci measuring 0.5 to 1 mm in size (Fig 3 and 4). Ovarian follicles and testicles were congested. Kidneys were enlarged, congested with petechial haemorrhages. Gross lesions observed during the necropsy of birds might be due to vascular damage of capillaries and post capillary venules induced by circulating endotoxin produced by *P. multocida* alone or in combination with products of inflammatory cells (Srinivasan *et al.,* 2011; Goswami *et al.,* 2022; Kannaki *et al.,* 2022).

Leishman's staining of the liver and spleen impression smears revealed the characteristic bipolar cocco-bacillary organisms suggestive of *Pasteurella species*. Heart blood swab and tissue samples produced small, glistening, mucoid, dew drop like colonies in nutrient agar plates after overnight incubation at 37°C. The bacteria were found to be non-hemolytic on blood agar and no growth on McConkey's agar, Eosine methylene blue agar and Salmonella-shigella agar. Gram staining of the individual colonies revealed Gram negative coccobacillary rods. Biochemically the isolates were positive for indole, nitrate reduction, oxidase and catalase and negative for methyl red and Voges-Proskauer tests which are specific characters of *P. multocida*. The carbohydrates fermented were glucose, mannose, galactose, fructose, sucrose and manitol and the carbohydrates that were not fermented included rhamnose, cellobiose, raffinose, inulin, erythritol, adonitol, m-inositoland salicin. The results of morphological, cultural

Fig 3: Liver enlarged with multiple necrotic foci randomly distributed on the paranchyma.

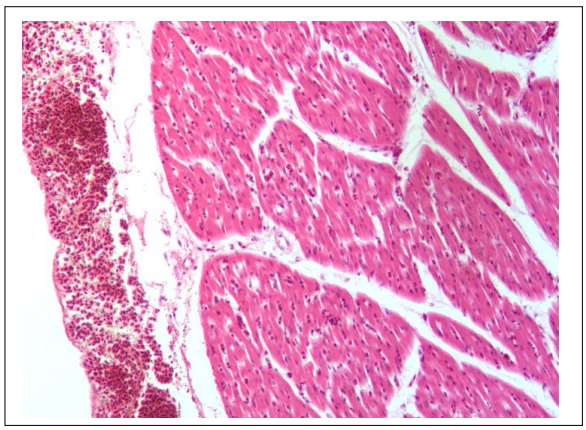

Fig 5: Heart showing haemorrhagic exudate on epicardial surface. H and E ×100.

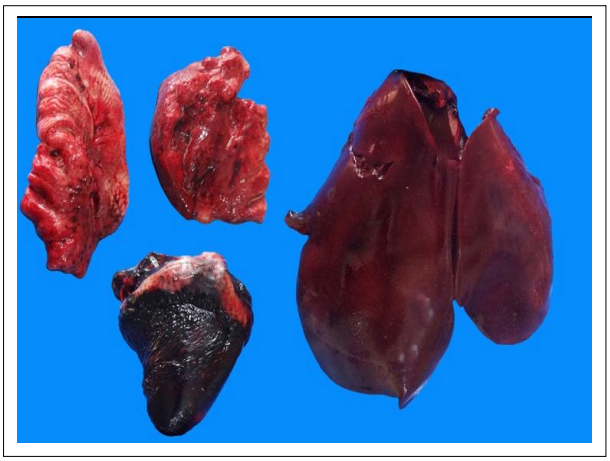

Fig 4: Lungs were congested, edematous with petechiae. Heart showing suffusive haemorrhage. Liver enlarged with necrotic foci.

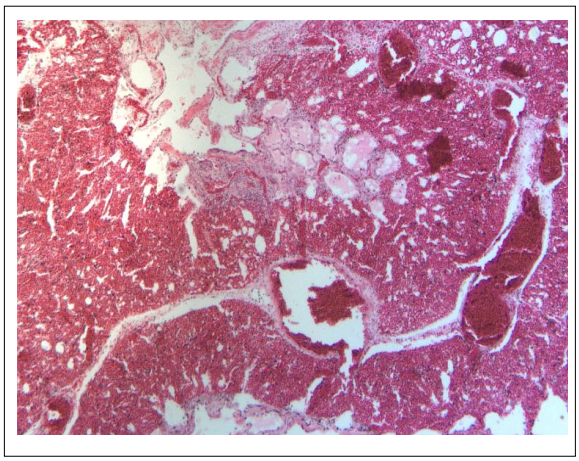

Fig 6: Lung showing mutifocal thrombi in small vessels with homogenous fibrinous exudates in parabronchial lumens. H and E ×100.

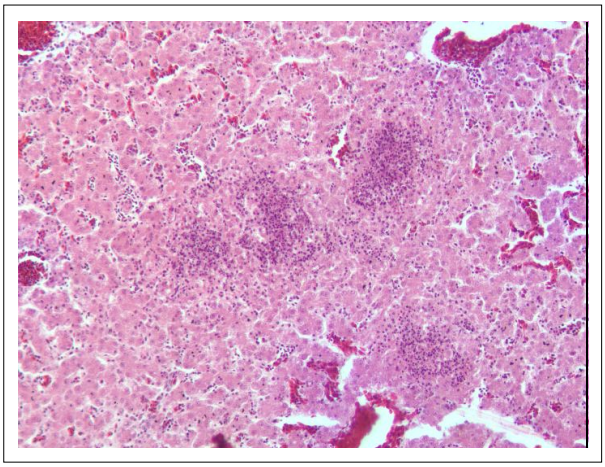

Fig 7: Liver showing multifocal coagulative necrosis with bacteria and heterophilic infiltrations. H and E ×100.

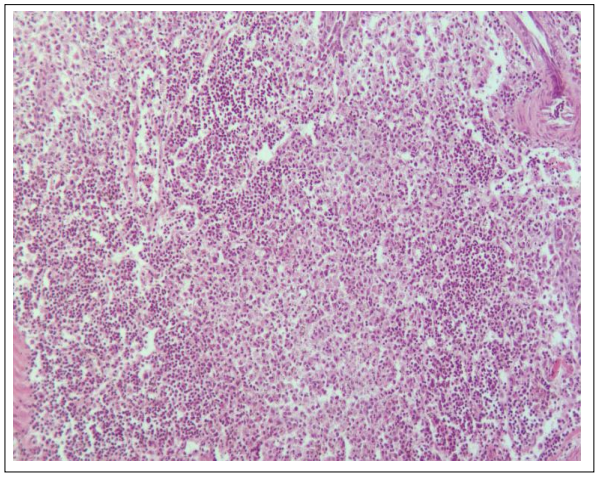

Fig 8: Spleen showing lymphoid depletion and moderately increased reticulocytes. H and E × 100.

and biochemical tests confirmed the causative agent as *P.multocida*. These findings were in agreement with several other studies (Shivachandra *et al.,* 2005; levy *et al.,* 2013; Panna *et al.,* 2015; Borah *et al.,* 2023).

Histopathological examination of heart exhibited epicardial haemorrhage and myocardial congestion and hemorrhage with moderate degeneration of myocardial fibers (Fig 5). Mutifocal thrombi of the small vessels were found in the lungs, with homogenous fibrinous exudates in the parabronchial lumens (Fig 6). Liver revealed diffuse vacuolar changes of hepatocytes, multifocal coagulative necrosis with bacteria and heterophilic infiltrations (Fig 7). Congestion and hemorrhages were noticed in the surrounding hepatic sinusoids, which were filled with many erythrocytes and mononuclear cells. Depletion of lymphocytes in lymphoid follicles and moderately increased reticulocytes, necrosis and karyorhexis of leukocytes with accumulation of heterophilic exudate was noticed in red pulp (Fig 8). Focal fibrin deposition was also noticed in red pulp. This could possibly signify that the birds were responding to the inciting bacterial agent which is a common characteristic in the acute form of fowl cholera. The microscopic lesions are in consensus to the findings reported by Kwon and Kang, (2003) in fowl cholera outbreaks in waterfowl.

CONCLUSION

Pasteurella multocida is an important pathogen of the duck industry and cause acute to chronic infection. In the present study, the cause of persistent mortality in adult breeder meat ducks was confirmed as *P. multocida* by their staining, morphological and biochemical characteristics. The clinical symptoms in affected birds and pathological changes observed in dead birds were consistent with duck cholera. Further studies on the molecular characteristics of pathogen and various predisposing factors are essential in order to contain the disease.

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Conflict of interest

All authors declared that there is no conflict of interest.

REFERENCES

Baki, M.A., Islam, R.M., Das, P.M., Karmaker, P.K. and Mondal, M.M.H. (1991). Pathology of duck cholera in natural and experimental infections. Bangladesh Journal of Microbiology. 8: 1-4.

Bhattacharya, A. (2005). Isolation, characterization and antibiotic sensitivity of *Pasteurella multocida* from incidence of duck cholera in Khaki Campbell and Vigova Super-M duck in Tripura. Indian Veterinary Journal. 82: 203-205.

Borah, B., Hazarika, R., Deka, P., Saikia, D.P., Doley, M.K., Sinha, S. and Sharma, R.K. (2023). Characterization of *Pasteurella multocida* and *Riemerella anatipestifer* of Ducks in Assam, India. Indian Journal of Animal Research. doi: 10.18805/IJAR.B-4977.

Christensen, J.P. and Bisgaard. M. (2000). Fowl cholera. Revue Scientifique et Technique. 19: 626-637.

DAHD, (2019). 20th Livestock Census, Department of Animal Husbandry and Dairying, Govt of India. Available in: https://www.dahd.nic.in/division/provisional-key-results-20th livestock-census (Accessed on 12/11/2023).

Das, U., Biswas, G., Bhattacharya, H.M., Mohanta, S.K. and Mukherjee, M. (1991). Outbreaks of duck cholera in West Bengal. Indian Journal of Poultry Science. 26(1): 60-61.

Goswami, P., Kamil, A., Kawoosa, M.S. and Shah. A. (2022) Occurrence of sub acute fowl cholera in a layer flock of Vanaraja Bird. International Journal of Agriculture Sciences. 14(3): 11166-11167.

Hossain, S., Saha, S., Rahman,M.T., Choudury, K.A. and Das, P.M. (1999). Clinicopathological findings of experimentally induced *Pasteurella multocida* infection in white leghorn chickens. Bangladesh Veterinary Journal. 33: 41-47.

Hunter, B. and Wobeser, G. (1980). Pathology of experimental avian cholera in mallard ducks. Avian disease pp: 403-414.

Ievy, S., Khan, M.R.F., Islam, M.A. and Rahman, M.B. (2013). Isolation and identification of *Pasteurella multocida* from chicken for the preparation of oil adjuvanted vaccine. Bangladesh Journal of Veterinary Medicine. 2: 1-4.

Islam, M.A., Samad, A., Rahman, M.B. and Kabir, S.M.L. (2003). Clinicopathological changes of experimentally induced fowl cholera in Jinding ducks. Bangladesh Journal of Veterinry Medicine. 1(1): 9-13.

Kannaki T.R., Priyanka E., Abhilash M., Haunshi Santosh (2022). Differential disease resistance of indian native chicken breeds to experimental *P. multocida* infection. Indian Journal of Animal Research. 56(2): 239-242. doi:10.18805/IJAR.B-4536.

Kumar, A.A., Shivachandra, S.B., Biswas, A., Singh, V.P., Singh Vijendra, P. and Srivastava, S.K. (2004). Prevalent serotypes of *Pasteurella multocida* isolated from different animal and avian species in India. Veterinary Research Commmunication. 28: 657-667.

Kwon, Y.K. and Kang, M.I. (2003). Outbreak of fowl cholera in baikal teals in korea. Avian Diseases. 47(4): 1491-1495.

Lee, MD., Glisson JR and Wooley RE (1992). Factors affecting endotoxin release from the cell surface of avian strain of *Pasteurella multocida*. Veterinary Microbiology. 31: 364-378.

Panickan, S., Dandapat, S., Kumar, J., Mahendran, M., Nandi, S., Punnoose, P. (2020). Molecular characterization and pathogenicity of an Indian isolate of duck enteritis virus recovered from a natural outbreak. Indian Journal of Animal Research. 55(6): 636-641. doi: 10.18805/ijar.B-4006.

Panna, S.N., Nazir, N.H., Bahanur Rahman, M., Ahamed, S., Saroare, G., Chakma, S., Tazrin, K. and Majumder, U.H. (2015). Isolation and molecular detection of Pasteurella multocida Type A from naturally infected chickensand their histopathological evaluation in artificially infected chicken in Bangladesh. Journal of Advanced Veterinary and Animal Research. 2(3): 338-345.

Park, N.Y. (1982). Disseminated intravascular coagulation (DIC) in experimental Fowl Cholera of chicken. Korean Journal of Veterinary Research. 22: 211-219.

Quinn, P.J., Carter, M.E., Markey, B.Kand Carter, G.R. (1994). *Pasteurella* sp. Clinical Veterinary Microbiology, Wolfe Publishing, London. P. 258.

Shivachandra, S.B., Kumar, A.A., Gautam, R., Saxena, M.K., Chaudhuri, P. and Srivastava, S.K. (2005). Detection of multiple strains of *P. multocida* in fowl cholera outbreaks by polymerase chain reaction-based typing. Avian Pathology. 34: 456-462.

Srinivasan, P., Gopalakrishnamurthy, T.R., Mohan, B. and Saravanan, S. (2011). Occurrence of subacute fowl cholera in a broiler flock. Tamil Nadu Journal of Veterinary and Animal Sciences. 7(1): 45-47.