SMU
Sikkim Manipal University
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INSPIRED BY LIFE
SMU Medical Journal
ISSN : 2349 – 1604 (Volume – 2, No. 1, January 2015) Review article

Zoonotic Implication of Duck and Chicken Diseases on Public Health Concern

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Manuscript received : 13.11.2014
Manuscript accepted: 12.12.2014

Abstract

This article is related to zoonotic diseases of poultry origin. There are several infectious diseases in poultry those may communicate to human being through direct and indirect contact and through food chain. The most lethal pandemic diseases is avian influenza or bird flu. So far a number of 379 people died of the this lethal disease of poultry origin. Other important poultry zoonotic infections are Chlamydiosis or Ornithosis, Newcastle Disease or Ranikhet diseases, Salmonellosis, Campylobacteriosis and Avian Tuberculosis. Those work related to poultry, duck, geese, turkey etc need to protect themselves from direct and indirect contact. Proper protective dress and regular disinfection of farm equipments and farm persons are required. Vaccination with bird flu to poultry workers, vaccinate to the birds with schedule vaccines are necessary. Meat, eggs, their products and value additions should be consumed with proper cook and sterilization.

Key words **:** **P**oultry Zoonosis, bird flu, salmonellosis, Chlamydiosis, Newcastle Disease, Avian Tuberculosis

Introduction

Poultry meat represents nearly one third of total meat production globally. Although the people of India are mostly vegetarians but due to increase purchase capacity and social change, the consumption of meat particularly chicken and duck is increasing. Moreover, poultry including chicken, turkey, duck and quail are mainly reared to supply cheap source of egg proteins. The production of poultry meat and egg has been increasing steadily since 1970. Moreover, the staple feed ingredients for poultry are wheat, maize, jawar, bajra and sayabeam are abundantly produced in Indian soil those helps for poultry production in private sector [1]. The total GDP of Indian economy is about1.38% from poultry Industry, The average growth rate in poultry Industry in India is about 5-6%, while the growth in egg production is 10-12%. An estimated 1.6 million people are directly involve in the poultry Production in India[2]. Zoonotic diseases are those diseases which are transmitted from animals to human. A number deadly infectious diseases are there for poultry population like Avian Influenza,Chlamydiosis,Histoplasmosis, Newcastle Disease, Salmonellosis, West Nile Virus. Some those infectious agents also cause infection to human being through direct and indirect process[3] . The diseases may be transmitted from birds to human being through contact of birds, fomites, utensils, inhalation meat and meat food products, egg, feed, water, bites, scratches etc. For the transmission of zoonotic diseases there is interaction amongst the susceptible host-diseases agents-environment called **disease triad.** To prevent the zoonotic disease breaking of this triad is the key is a must.

The two most lethal diseases those lead very high morbidity and mortality are Newcastle disease and avian influenza (bird flu). Other poultry diseases include chronic respiratory disease, fowl cholera, Salmonella, Campylobacter and some internal parasites. Salmonella and Campylobacter infections are highly contagious in poultry but not necessarily life-threatening chicken and duck. These diseases can however cause serious illness in humans if they get into the food chain. Again chicken influenza (bird flu) caused by H_5N_1 is very epizootic diseases can harm the public health with quite mortality. Duck and other water fowl acts as reservoirs for all most all serovars of influenza (H1 to H17). These waterfowl may act as constant source for frequent outbreaks in human and chicken flu.

Therefore, care needed to protect human health and wildlife health from these infections. Personal protective quipment, preventive treatment, Prevention to mechanical transmission

and disinfection of potential sources of infection is needed.

Avian Influenza (bird Flu)

Influenza actually referred to epidemics of acute rapidly spreading catarrhal fever in humans, animals and birds caused by viruses of Orthomyxoviridae. Some species specific virus cause clinical signs in human (H1N1, and H3N2), chicken (H5N1,H7N7, H5N2, H7N3,H7N4), Turkey (H5N1,H7N3,H5N9, H7N7,H5N8),Swine (H1N1,H3N2, H1N2). Duck can harbour almost all serotypes (H5N1,H1N1,H1N8,H2N9,H3N8,H4N6) of influenza A viruses. In human and birds since 2003, highly pathogenic avian H5N1 strains circulating in parts of Asia, especially India, Indonesia, Europe, Middle East, Africa. A number 638 patients reported influenza withH5N1 of which 379 deaths corresponding 59% mortality. Human mortality due to flu is highest in Indonesia (193/161) 83% followed by Cambodia (38/29) 76%, Thailand (25/17) 68%, China (45/30) 67% ,Vietnam (125/62)50% and Egypt (173/63) 36%. There several other countries reported morbidity and mortality on bird flu but till date no cases reported from India.. It is postulated that an pandemic outbreaks of influenza flu in human being is expected by 2017 with high mortality like Spanish influenza in 1918-19.

Transmission to human

Direct contact with infected birds, contact with surfaces contaminated with feces, oral or nasal discharge from infected birds. Handling of hen and duck eggs, consuming of raw or undercooked poultry eggs, meat and poultry products

Clinical signs in poultry

Severe respiratory signs like sneezing, coughing, rales, coughing, wheezing, oculo-nasal discharge occasional diarrhoea, roughffled feather, emaciation in recovered birds. Highly pathogenic form with torticolis, opisthotonus, respiratory disorders and damaged of multisystemic organs. Behavioural changes of incoordination in movements, unable to stand, abrupt production drops, diarrhea and dehydration**.** Duck flue with clinical infection and symptoms is rare. Several influenza lethal viruses like H7N2, H4N1, H1N1 experimentally inoculated in ducks revealed lacking of clinical signs although high titer of virus excreted

through feces and other secretions. Very scant antibody response was detected in ducks. It is believed that duck acts as reservoir of the influenza virus however, several report of duck influenza have been reported with some clinical signs [2, 4] .

Clinical signs in humans including fever, sore throat, snzeeing, cough, muscle aches, eye infections, pneumonia and severe respiratory reactions.

Pathological changes

Birds those die of peracute diseases may show mild lesions, high dehydration and congestion. Mild pathogenic influenza characterised by catarrhal, serofibrinous and mucopurulent inflammatory changes in sinuses. Tracheal oedema, congestion and haemorrhages with caseous exudates, fibrinous sacculitis, egg yolk peritonitis, and thin wall egg shell due oviductal inflammatory changes. In highly pathogenic avian influenza (HPAI) oedematous, haemorrhagic and necrotic lesions in several visceral organs are seen. Swollen head, face, neck,skin, and feet are common. Haemorrhages prominent on pericardium, pectoral muscle, proventriculus and ventricles. Necrosis in pancreas, spleen, heart, liver and kidney with urates deposits are obvious.

Diagnosis

Diagnosis of influenza virus need specialized virological laboratory facilies with BSL 3+ lab. There are several cultural, serological and molecular diagnostics for flu virus infection. Isolation of virus can be done Madin- Darby canine kidney cell line is ideal for isolation of flu virus. Virus neutralization test in the most perfect serological test, microneutralization is usually done for easy diagnosis. Agargel immunodiffusion test, Immunofluorescent staining ,immunohistochemistry, Amplification of gene (HA,NA etc) through PCR are the most reliable test for influenza diagnosis.

Therapeutic intervention

Treatment for HPAI needs antiviral drugs and supportive care. For poultry, there is tittle therapeutic use of antiviral drugs and vaccination. Currently the are two classes of antiviral drugs are available (a) ion channel inhibitor (M2 protein segment connecting outside capside) and neuraminidase inhibitor. The ion channel inhibitors such as Amantadine hydrochloride

and Rimantadine block the ion channel protein of the influenza virus A preventing the release of vRNP complex into the cytoplasm of infected host cells. The Neuraminidase inhibitor such as oseltamivir and zanamivir block the sialidase activity of NA protein which is critical for effective release of virus protein from infected cells. Antiviral drugs like Tamiflu(Roche, 75mg tab for 7 days**)** may be used for those people who handle birds and products**.**

Chlamydiosis or Ornithosis or Psittacosis

Chlamydiosis is caused by a Gram negative minute (0.4-0.6µm) bacteria called *Chlamydia psittaci* usually systemic and fatal infection in birds characterized by lethargy,respiratory stress, hyperthermia, oculonasal discharges, yellow diarrhoea, and reduced egg production.
The bacteria have a wide range of host of pigeon,quail, dove, turkey, duck, swan, chicken, sheep, goat and cattle

Transmission, carrier and vector

Primary transmission occurs through air. Nasal, ocular, fecal and feather dust are the origin for aerosol infection. Fecal, urine and body discharges are dried and become dusty, wing flapping and wind flow can infect fresh host through inhalation. Vertical transmission through the egg has been shown in domesticated ducks. Recovered bids and pigeon act as carriers while some arthropod is considered vector. Over crowd, nest box, old environment, pet shop, chicken shop,quarantine centre are the source of infection. Infection from birds to humans particularly in sick, elderly, immunosuppressed (e.g., HIV patients) or pregnant. People who handle and process the duck, tuekey,poultry and their productsd are in high risk. Most infections with inhalation of aerosol from duck, poultry, processing and feather processing sheds.

Clinical manifestation

Duck is more susceptible than chicken. Young birds show rough plumage, low body temperature, tremor, lethargy, conjunctivitis, dyspnea, emaciation, sinusitis, yellow to greenish droppings. Adult birds may develop symptoms such as tremors, lethargy, ruffled feathers, progressive weight loss, greenish diarrhea, occasional conjunctivitis, and high

levels of urates in feces. In humans, abrupt onset of fever, chills, headache, loss of appetite, shortness of breath, malaise, myalgia, and conjunctivitis can occur as a result of a Chlamydia infection.

Gross lesion

Lower respiratory tract with thickened air sacs with infiltrated with fibrin plaques,the can also be found in pericardium.GI tract show vascular congestion coated with fibrinous exudates.There may be enlargement of lung and liver.

Diagnosis of Chlamydiosis

The organism can be cultured into tissue cell lines. Tissue homogenates can be inoculated into embryonated chicken eggs. Mice inoculation test this tissue homogenates for chacteristic pathology. Tissue sample can be stained for intracytoplasmic inclusion and elementary bodies. Specific antibody conjugated with fluoresein dyes staining can be good for identification[5].

Therapeutic and Control

No effective vaccine has been developed. Treatment with Chlortetracycline 400g/ton of feed can be fed in endemic areas. Restriction of entry of fee living birdslike pigeon in the poultry or duckery. People work in poultry should use wear musk, protective clothing, gloves, cap and wet the premises when over dusty environment to restrict dust movement.

Newcastle Disease

It is a paramyxo viral disease of more than 200 species of domestic and wild birds including chicken, lesser extend in duck and turkey, characterized with listlessness, respiratory stress, weakness prostration and deaths. It has several other names like Aian pest, Ranikhet disease, Avian pseudoencephalitis, Doyle's disease.

Transmission

The virus can be transmitted by either inhalation or ingestion through feed and feces. Infected and recovered birds are sources of new host infection. Feral birds, game birds, fomite, water

and farm equipments are also sources of infection.The incubation period 2-15 days. Human infections of Newcastle Disease virus (NDV) usually results from direct contact with viral infected eye rubbing with hands, handling of infected allantoic fluid in egg handling, handling with carcass died of NDV, persons vaccinating with aerosol vaccine may contact eye and casual contact with infected poultry and poultry products.

Clinical signs

There are three forms of clinical signs namely velogenic, mesogenic and lentogenic. The velogenic form with severe respiratory distress, litlessnees, weakness, prostration followed by neurological signs oftorticolis, paralysis, of appendages and acute high mortality. Mesogenic for characterized by similar signs of velogenic but milder, drop of egg production for several days. Milder severity with out nervous signs. Lentogenic is restricted to low age groups of birds where respiratory distress is severe. The disease in duck is milder and geese is resistant.

NDV is a human pathogen and the most common sign of infection in humans is conjunctivitis within 24 hours of NDV exposure to the eye [6]. The pathogenicity in human is not life threatening or debilitating like birds. Ocular infections, usually consisting of unilateral or bilateral reddening, lachrymation, oedema of the eyelids, conjunctivitis and sub-conjunctival haemorrhage. The conjunctivitis may be severe enough but it does not lead to cornea involvement. There is no evidence of human-to-human spread. A very few report of immunocompromised patient showed lung involvement[7].

Pathological lesions

Gross lesions depends on virulency of strains of virus. Generally haemorrhagic and necrotic lesions in intestines, proventiculus, caeca, and small intestine. Pathological lesions may be in Central Nervous system (CNS) with non purulent encephalomyelitis and neuronal degeneration.. Respiratory tract mucosae is haemorrhagic and tracheal congestion are evident. Air sacculitis, thickening of the sacs with catarrhal exudates is common. The ovarian follicles are flaccid and degenerative, haemorrhagic and discoloured. Blood vessels congested, oedematous and haemorrhagic.

Diagnosis of New castle diseases

Diagnosis of NDV infection can be done through various methods. Clinical signs and pathological lesions are quite informative to diagnose the NDV infections. Isolation and identification of virus can be made by various cell culture, inoculation into9-10 days embryonated chicken eggs from specific pathogen free flocks. The recommended *in vivo* intracerebral pathogenicity index (ICPI) test in day-old chicks. This involves the inoculation of virus derived from fresh infective allantoic fluid into the brain of ten day-old chicks from specific pathogen-free parents. The most virulent viruses give ICPI values approaching the maximum score of 2.0, while lentogenic viruses give values of, or close to, 0.0. Immunogenic techniques for rapid methods of identification by immunofluorescent technique. Serological test like single radial immunodiffusion, agar gel precipitation and haemagglutination inhibition tes**t** are also diagnostic tools**.** Monoclonal antibodies (MABs) are used for routine diagnosis (ELISA). Molecular diagnosis with PCR by amplification of DNA copy using a universal primer.

Therapeutic intervention of NDV

The deadly infection in chicken has little impact on use of antibiotic in the face of outbreaks. In chicken the deadly disease is controlled only by routine vaccination. The F1 strain vaccine is done on o day old chicks followed by R_2B vaccine for all ages. There are several live and killed vaccines used to control deadly NDV infection. The vaccine can be used through different routes like ocular, nasal installation, drinking water, spray over poultry population and inject able. For human infection care must be taken to handle birds, eggs, feed, and poultry equipments. Use of musk, gloves, full sleeve shoes, apron and disinfection are necessary for handling poultry.

Salmonellosis

Salmonellosis in duck and chicken may be due to three species of *Salmonella typhimurium, Salmonella enteritidis* and *Salmonella anatum* out of about several species. In duck and chicken the disease Salmonellosis is called "Keel disease" or paratyphoid or Pullorum disease in chicken. The disease is characterized by weakness, depressed appetite, poor growth, chalky white diarrhoea, vest pest with feces, neonatal death post hatching, laboured breathing and

sometime, blindness.

Transmission

Transmission mostly to the host by vertical transmission from parent to their following generations, however, direct contamination is not uncommon**.** The mortality and morbidity due to salmonellosis depend on the host specificity and recovered birds. Mortality may vary from 0 - 100%. Difficult experimental infection with salmonella S. typhimurium, S. enteritidis, S. heidelberg and S. orion that colonize the gut wall and were excreted in the faeces for 6 weeks by ducks when they were infected orally within 2 days of hatching. Human being is infected with contaminated food like raw eggs and under cooked eggs, meat and meat products and contact with infected birds.

Clinical Findings

Chicks may be found dead just after hatching, if survived there may somnolescence, weakness, loss of appetite, poor growth, chalky paste like feces, droopy wings, inclination to move and huddle together. In extensive invasion laboured breathing with poor feather, if survived for long illness become carriers. Localized involvement of swelling tibiotarsal and humeroradial joints leads to lameness and blindness. In adult, there may be reduction of egg production, loss of fertility and hatchability. The clinical signs of duck are similar to chicken, in addition there may be respiratory and tracheal involvements. Clinical signs in human beings are diarrhoea, nausea, volition, abdominal pain and cramps and fever within 12-72 hours of infection.

Pathological lesions

The incidence and lesions with Salmonellosis is sporadic, in chicks there may no lesions at all in some cases. In acute cases enlargement of liver, spleen, kidney may be seen. Ducklings of ducklings and chicks Omphalitis with unabsorbed yolk may be found. Lung and heart tissue may contains white nodules. Some joints may be swollen containing yellow fluid. Adult birds may show ovarian follicular nodules may be seen which may further enlarged to pendulous abdomen. Pericardium may inflammatory, testicle may be with white foci and nodular appearance. In human mild lesions in GI tract in acute cases.

Diagnosis

Clinical signs may provide tentative diagnosis. Isolation and identification of causative bacteria may be made in different media (**Tetrathionate Brilliant Green** bile **Broth,** triple sugar broth) with characteristic colony characters and biochemistry. Serologically tube agglutination test, rapid serum test and ELISA are to mention..

Treatment and prevention

Clinical cases may be treated with antibiotic after proper sensitivity tes,sulohonamide, nitrofurans, chloramphenicol are effective drugs. Reactor birds and possibly the whole flock may be culled and destocked by destroying them. Hatching should be done with known uninfected eggs. Human cases symptomatic treatment with electrolyte replacement , such as sodium, potassium and chloride ions and rehydration therapy is needed. Proper cooked eggs and meats should be taken.

Avian Tuberculosis

Mycobacterium avium infections are found worldwide in a myriad of chicken, duck, geese, swans, turkey and other domestic and wild birds[8]. The causative agent is Mycobacterium. avium serovars 1, 2, and 3. It is mainly found in backyard birds and rarely seen in commercial flocks due to modern management practices and prolong incubation period.

Transmission

In poultry huge amount of Mycobacteria shed from the intestine of infected birds are the source of infection. Infected soils remain the potential contaminant for long time. Infected carcass may also be source of dissemination of the bacteria. Poultry workers may spread through shoe, equipment, feed and water. Feral birds like sparrow and pigeon may spread the infection from farm to farm. Human may be infected with Mycobacterium avian who works in poultry farm, immunosuppressive patient (AIDS) and consumption of infected poultry food.

Clinical findings

The clinical signs in avian TB is not very pathognomic, chronic infection can be showing

fatigue, depressed, loss of weight, atrophy of breast muscle with spine keel. Ruffled feather, palor of comb, wattle, crest, bill and ear lobes of duck and chicken. Unilateral lameness and jerky gait may be seen. Tubercular arthritis and paralysis are also not very rare. Progressive emaciation, nodular intestinal mass may be palpable in advanced cases. Nodular ulceration in intestine may lead to diarrhoea.

Pathological lesions

Lesions are seen in liver, spleen, intestine and bone marrow. Sometime heart, ovaries, testes and skin may be affected. In turkey, ducks and pigeons prominent lesions are seen in liver and spleen. Pinpoint to pea size nodules may be seen in these organs but larger nodules may be formed in liver and spleen. Intestinal nodule may bulge out to serosal surface. Granulomatous growth in bone marrow. In humans, M. avium infection is rare from birds is extremely rare in immunocompetent individuals and most often occurs in immunocompromised patients, such as AIDS/HIV patients.

Diagnosis of Avian TB

Clinicopathological lesions are the main tools for TB diagnosis. Fecal and histological section samples of liver, spleen, intestine can be stained for acid –fast bacilli. Cultivation in specific media needs time and usually frustrating. Tuberculin test and Rapid agglutination test are satisfactory for diagnosis avian TB.

Control of Avian tuberculosis

Reactor birds should be culled after testing, experimental chicken oral vaccine protect 70%. Antitubercular drugs like isoniazid, ethambutal, rifampicin are good drugs but have limitation to use for cost and long therapeutic effectiveness. However, human patient are treated with these drugs.

There other several viral and bacterial infections those have zoonotic importance related to poultry, duckery and their products and value addition products. People who work to the poultry industry and consumers are very prone to get infection with these diseases. Some other infectious diseases of poultry (chicken, duck and geese) which have important role as

zoonosis are *Campylobactor jejuni, West Nile virus, Histoplasma capsulatum* etc. Escherichia coli (Colibacillosis), Bordetella pertusis (hooping cough), Mycoplasma meleagridis etc.

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Authors Column

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Dr. Mondal has 24 years experience in research, training and extension. He has developed health calendar of small ruminants and duck and test kit of Johne's diseases (AGID). He has to his credit 39 research papers published in national and international journals and wrote 4 book chapters. He bagged two awards from the Indian Society for Veterinary Medicine and one award from the Animal Nutrition Society of India. He is also the recipient of Bharat Gaurav award.

SMU Medical Journal, Volume – 2, No. – 1 , January, 2015, PP. 317 – 329.