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Review article:

Mycoplasma gallisepticum Infection in Poultry: Article Review

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Abstract

Mycoplasma gallisepticum (MG) is the most important causative factor of respiratory infections in chickens and turkey resulting chronic respiratory disease CRD and Infectious sinusitis respectively. These diseases transmitted throughout the world in different ages of to all nearby bird species. The infected poultry become carrier that can infect all birds around world. This review introduces a short information about MG infection specially in avian species. The detection of this causative agent made by isolation of MG by serological test or culturing with media containing digested protein, meat infusion base with serum, yeast factors, glucose and bacterial inhibitors on many commercial liquid media and agar media used for isolation like: Frey medium and SP-4 medium and other isolation methods like rapid agglutination test which made by several methods can be used to diagnosis the MG like: Haemagglutination inhibition, ELISA, PCR and molecular methods to differentiate between MG strains, DNA fingerprinting that uses RAPD (random amplified polymorphic DNA), GTS (gene targeting sequencing) for typing strains.

Keywords: *Mycoplasma gallisepticum*; Avian; Respiratory diseases.

Introduction

With a world-wide distribution, *Mycoplasma gallisepticum* (MG) has the greatest significant infections that cause high economic losses in avian species, as highly transmissible avian pathogen (1). It is the primary causes of chronic respiratory diseases (CRD) infection in chicks and infectious sinusitis in turkey, of all types and ages. *M. gallisepticum* infection is spread horizontally from one fowl to another; moreover, it can be vertically (1). Primary description of the disease by Dodd 1905 (2) in England named "epizootic pneumoenteritis" was observed in turkeys (2). *M. gallisepticum* diseases are specifying by respiration rales, nasal and ocular discharge, coughing and conjunctivitis. In the turkey's species, often infraorbital sinusitis is present (1). Clinical manifestation typically emerges gradually, and the infection may last for a long period. As a result, the carrier bird continues to harbor the disease throughout its lifetime, posing a threat to other avian populations (3). Decrease in growth and production are prominent in MG infection (4). Initial damage usually be made of heterophils and macrophages, and subsequent damage demonstrate huge quantity of lymphocytes along excessive parts of T-lymphocytes (5). Like the other members of the class Mollicutes, family Mycoplasmataceae, the genus of Mycoplasma lacks a cell wall and are smallest self-replicating prokaryotes with reduced genome, with the minimal genetic information, many metabolic pathways and the capability of growing on artificial cell-free media (6). These characters relate widely to MG and the host species, moreover, the organism is very sensitive to nature where there is difficult in culturing, selective antibiotic sensitivity, inhibition of phagocytosis, and its intimate association with host cells. MG constitutes of two duplicate of a 23S-5S rRNA gene aggregation, both not found close to single 16S rRNA gene (7). *M.*

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gallisepticum was first identified as serotype A (8 & 9) to distinguish it from other avian mycoplasmas (10). By 1993, molecular techniques helped distinguish between mycoplasmas with antigenic and physical similarities (11). *M. gallisepticum* infections may be complicated by other respiratory virus infections such as infectious bronchitis (IB), Newcastle disease virus (NDV), Avian Influenza virus (AIV) and very often along with a secondary infection of *Escherichia coli*; Haemophilius, or avian rhinotracheitis virus causes severe air-sacculitis, also known as "Air sac disease", leading to aggravated clinical CRD, high morbidity, mortality and/or increased condemnations at processing (12). *Mycoplasma gallisepticum* features a small genomic size comprised of only 996442 bp nucleotides for Rlow strain (13) with limited biosynthetic capabilities. MG membrane proteins are crucial in establishing MG morphology, movement and colonization of the host (14 & 15). As an opportunistic pathogen, MG depends on its parasitic lifestyle and despite several limitations, their degenerative evolution allow them to transmitted through immobile surfaces, such as glass, plastic and eukaryotic cells, absentee of motion adjacent such as flagella or pili (16). Antigenic variation, phase variation, superantigens are a few of the mechanisms adopted by MG to evade the host's lymphatic system (1). In chickens, *M. gallispeticum* is outlined by excessive infection in trachea, air sacs and lungs; conjunctivitis; rales; nasal and mucosal discharge. MG attached to the tracheal epithelial cells mediating filtering of macrophages, heterophils and lymphocytes to the tracheal connective tissue. Yet, molecular mechanism of infectious associated with excessive infectious MG, associated with excessive infection reaction, is elusive (17). Of an infinitesimal size and minimal genetic information, MG lack bacterial cell wall; and hence it is unaffected by ß-lactam antimicrobials which target cell wall synthesis. *Mycoplasma gallisepticum* have the ability to penetrate cells; possess a trilaminar membrane and they are highly polymorphic. MG is facultative anaerobes with optimal temperature of 35-37 C^{o}; and requires an enriched media of 10-20% animal serum and yeast extract. MG causes significant economic losses despite the absence of clinical signs. Condemnations in body, feeding decrease efficiency with decrease of egg producing, reduced hatchability and growth, aggravating and co-existing with other disease agents and increase in medication or vaccinations (11). MG outbreak persists in many countries around the globe and various measures have been enforced with outcomes demonstrated far from satisfactory. Extensive biosecurity and surveillance is a well control MG-program, in the United States, an extensive National Poultry Improvement Plan has been adopted by hatcheries and poultry breeders with success in increasing MG-free flock. The isolation of MG can be done by serological test by detecting DNA directly in infected birds. Culture media contain digested protein, meat infusion base with serum, yeast factors, glucose and bacterial inhibitors (18). Rapid agglutination test one of serological tests that used commonly within three days of sample collection (19). Several methods can be used to diagnosis the MG like: Haemagglutination inhibition, ELISA, PCR and molecular methods can differentiate the MG strains, DNA fingerprinting that uses RAPD (random amplified polymorphic DNA), GTS (gene targeting sequencing) for typing strains (20). Isolation of causative agent was slow requiring three weeks (21), with modification of media was added (22 & 23). Many commercial liquid media and agar media used for isolation like: Frey medium and SP-4 medium, the trachea or choanal cleft or even oviduct swabs can be taken (24). Best growth of MG achieved with 37 C^{o} in high humidity in 5% CO_2, the colonies can be seen after three to five days of incubation (21). The MG classic colonies were small, circular with elevated center like fried egg appearance. Using 16S rRNA gene and sequencing methods with highly specific results, also identification can be done using direct or indirect immune fluorescence techniques,

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immune-peroxidase, immunobinding assay. The controls of MG in many countries based on maintain the breeding flocks free from MG infection, the recovered birds had immunity but it still contains the organism. The using of antibiotics was very important in order to prevent attachment of organism with epithelial cells of birds (25). Infection affected cell immune system inducing lymphocytes stimulation (B and T) that lead to produce cytokines (26), natural killer and cytotoxic T cell (27), these inflammatory events occur after interaction of MG with mucosal surface of birds (28). Infiltration of heterophils, macrophages, lymphocytes, polymorphonuclear leukocytes and natural killer also involve in innate and adaptive responses (29). Antibodies in respiratory secretion protect against MG infection by inhibiting the attachment of organism with tracheal epithelia cells (30), by release antibodies including IgA, IgM, IgD, IgE and IgG (31). Vaccinations methods was the best for controlling and maintain the breeding flocks free, there were two types of live vaccines: intranasal or in eye drop and the second type was the fine spray one. Large range of choice were available including vaccination activated, oil emulsion bacterins, live or recombinant live vaccines (32). MG shows sensitivity inside and outside body for many antibiotics like macrolides (erythromycin, tylosin, spiramycin, licomycine and kitasamycin), tetracyclines (oxytetracycline, chlortetracycline and doxycycline) and fluoroquinolones (imequil, norfloxacin, enrofloxacin and danofloxacin) and tiamulin, the treating birds with antimicrobials decrease the clinical symptoms and the risk of transmission between flocks. Medical plants such as tannins, terpenoids, alkaloids and flavonoids provides good source of anti-infection against microbial agents, and these plants had many compounds treating or protects birds against infection (33). Several studies were done inside Iraq without referring to this important disease (34, 35, 36, 37, 38 & 39). Whereas some of authors published several works deal with this infection in birds (40, 41, 42 & 43).

Conclusion

The MG is the most important causative factor of respiratory infections in chickens and turkey this causative agents could be diagnosed using isolation procedures and molecular or serological methods and can be treated with several medical antibiotics and medical plants and could be controled using vaccination protocol.

Conflict of Interest: The author declares that there is no conflict of interest

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