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Respiratory Diseases in Poultry: A Constant Challenge

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Among the possible infectious agents that affect poultry, diseases of the respiratory tract are considered the main health problem, causing both an increase in the number of carcass condemnations and a decrease in the productivity of the flocks [1]. This situation can be partially justified by the avian anatomical characteristics and the propensity to the diseases [2,3]. If the avian evolutionary adaptation makes respiratory efficiency superior to that of mammals, this particularity also facilitates the occurrence of pathologies [4]. The narrow duct that communicates the nasal sinuses in birds, for example, makes it difficult to drain secretions. Likewise, the mucociliary apparatus - characteristic of the respiratory tract histology - is absent in the air sacs, so these structures are more predisposed and susceptible to infections [5]. Respiratory diseases are also the most common health problem among humans. Viral respiratory tract infections are the leading cause of disease and mortality in children under five years of age, who generally have six to eight infections per year [6,7].

It is obvious that this similarity is not due to similar anatomical characteristics between such distant species, but rather to the capacity of dissemination of respiratory agents through the aerial route. If we consider the total number of animals in each flock and the current high population density, especially in some traditional poultry activity regions, this capacity is accentuated. Similarly, children also become more susceptible to respiratory infections when they start school activities in classrooms with other colleagues [8].

It is important to note that respiratory diseases are not a constant challenge to the sector only by the anatomical or spatial characteristics. The concern and difficulties have been extended to the veterinarians in the field: diseases with similar clinical signs, coinfections of pathogenic agents, presence of concomitant immunosuppressive diseases and even post-vaccination reactions. In these situations, the natural defense mechanisms - filtration of inspired air, mucociliary epithelium and phagocytosis - are overcome [4]. Therefore, there is a dependence on laboratory diagnosis.

However, these challenges also continue in the laboratory, since there is a difficulty in associating the isolation of a unique strain of Escherichia coli, Staphylococcus aureus or Pasteurella multocida, for example, with the clinical cases observed in the poultry farms. It is difficult to know if the isolate plays a main or a secondary role in that scene. Recently, in previous works developed in our laboratory, we have observed the association of certain virulence genes or certain phylogenetic groups with strains of E. coli or P. multocida that present a higher pathogenicity [9]. Thus, the classification of the isolates in these two cases and the association with the clinical presentation in the poultry farms becomes possible.

In addition, the capacity for recombination and intrinsic mutation of some agents, such as avian influenza virus and infectious bronchitis virus [10,11], the data lack on the prevalence of the main respiratory diseases in each company and on the composition of the respiratory tract microbiota of birds [12] are other difficulties. Some of these difficulties are also reported in human medicine, such as the similarity of clinical signs and even the low sensitivity of culture methods [13]. The lower availability of antimicrobials for therapeutic use is an additional problem for veterinarians [14]. Also, respiratory disease agents are most frequently reported in zoonoses involving birds and they are transmitted by routes not related to food of animal origin. For instance, avian influenza virus, Newcastle disease virus or Chlamydia psittaci are potentially transmitted through aerosols or through direct contact [15].

Considering these difficulties, how can respiratory diseases be controlled? Once again we fell into the old, but efficient prevention measures that have always characterized the poultry health control. Adoption and update of biosecurity programs [15,16]vaccination and serological monitoring are essential. Regarding vaccination, the storing and the application failures, besides the presence of immunosuppressive diseases or concomitant respiratory infections need to be evaluated. In addition, the risk of virulence reversal of some traditional vaccines, such as the vaccines for infectious bronchitis, Newcastle disease and for infectious larigontracheitis should also be considered [17,18]. Obviously, the development of recombinant and subunit DNA vaccines is an available alternative. In fact, the limit for innovation in avian vaccination depends more on relevance to industry than on technical and scientific aspects [19]. It is known that more than 99% of the bacterial species are not cultivable in the laboratory. In addition, the cost of genetic sequencing techniques has decreased considerably in the last years [12, 20-22].

In this context, sequencing of metagenomes for the study of complex microorganisms communities have gained prominence. These studies may allow the discovery of new pathogens and their interaction in the development of respiratory diseases, as well as in antimicrobial resistance processes [21]. Concomitant to vaccination, serological monitoring is used to evaluate the sanitary status of a flock, the circulation of an agent for which animals should be considered free or as an auxiliary tool in the clinical diagnosis [22]. In spite of the competence of the professionals, antibodies title expected for a breeder flock in a specific age is not kwon in some cases, because the lack of parameters. In our previous works, the reproductive immune response is transformed into specific mathematical models that allow this monitoring [23]. Besides that, it is important to use the serological tests in an internal company program for the analysis of respiratory agents prevalence, in addition to those determined by the current legislation. It is known that respiratory infections are complicated and that the post-vaccine reactions are exacerbated when coinfections occur [4]. Likewise, the serotyping of respiratory agents in a specific region prior to the use of homologous vaccines is essential [24,25].

Thus, respiratory diseases have intrinsic characteristics that make them a constant challenge. The control and prevention are based on the continuous adoption and updating of the traditional biosecurity programs and on the use of classic or innovative methods of diagnosis and prevention. In fact, the choice between the traditional and the new methods, or even their association, depends on each context, as well as on the characteristics of each agent and on the relationship with the host and the environment. For instance, molecular diagnostic methods are effective in detecting genetic material. However, determining the viability of an infectious agent depends on conventional culture methods. Likewise, adopting a vaccine includes the analysis of the present challenge in the region and the related costs. Finally, as observed for other health problems, the control of respiratory diseases depends on the updating and the careful performance of professionals involved in the poultry chain.

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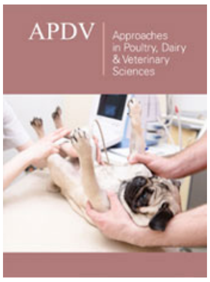

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