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Influenza vaccines and vaccination strategies in birds

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Abstract

Although it is well accepted that the present Asian H5N1 panzootic is predominantly an animal health problem, the human health implications and the risk of human pandemic have highlighted the need for more information and collaboration in the field of veterinary and human health. H5 and H7 avian influenza (AI) viruses have the unique property of becoming highly pathogenic (HPAI) during circulation in poultry. Therefore, the final objective of poultry vaccination against AI must be eradication of the virus and the disease. Actually, important differences exist in the control of avian and human influenza viruses. Firstly, unlike human vaccines that must be adapted to the circulating strain to provide adequate protection, avian influenza vaccination provides broader protection against HPAI viruses. Secondly, although clinical protection is the primary goal of human vaccines, poultry vaccination must also stop transmission to achieve efficient control of the disease. This paper addresses these differences by reviewing the current and future influenza vaccines and vaccination strategies in birds.
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Keywords: Avian influenza; Flu; Vaccine; Vector; Subunit; Immunity; Surveillance; DIVA; Eradication; H5N1

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Résumé

Bien qu'il soit à présent bien accepté que la panzootie au virus H5N1 asiatique soit avant tout un problème de santé animale, ses implications sur la santé publique et le risque de pandémie ont montré le besoin de plus d'information et de coordination entre le monde médical et le monde vétérinaire. Les virus du sous-type H5 et H7 ont l'unique propriété de devenir hautement pathogènes (IAHP) lors de leur circulation chez la volaille. Dès lors, l'objectif final de la vaccination de la volaille est l'éradication de la maladie. En fait, il existe d'importantes différences entre le contrôle de l'influenza aviaire et celui de la grippe chez l'homme. Premièrement, contrairement aux vaccins humains qui doivent être ajustés aux souches circulantes pour procurer une bonne protection, les vaccins aviaires fournissent une plus large protection contre les souches IAHP. Deuxièmement, alors que le but premier des vaccins humains est la protection clinique, les vaccins aviaires doivent aussi réduire la transmission du virus de manière à permettre le contrôle de la maladie. Cet article tente d'aborder ces différences en passant en revue les vaccins actuels et futurs contre l'influenza et les différentes stratégies de vaccination chez la volaille.
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Mots clés: Influenza aviaire; Grippe; Vaccin; Vecteur; Sous-unité; Immunité; Surveillance; DIVA; Éradication; H5N1

1. Introduction

In 2003, the highly pathogenic avian influenza (HPAI) H5N1 strain, starting circulating in Asia in 1996, became enzootic in poultry. Indeed, from December 2003 to April 2005, HPAI H5N1 caused outbreaks of avian disease in nine Asian countries [1–5]. This unprecedented spread of HPAI was associated with a failure of surveillance and control measures in these countries, allowing the spread of the virus to Middle East, then Europe in the summer of 2005, and later to Africa [6]. Another unprecedented feature of this H5N1 HPAI outbreak is its association with human disease and mortality. There was no report of human death due to avian influenza (AI) before the H5N1 avian flu alert in 1997 in Hong Kong, where 6 out of 18 human cases were fatal [7,8]. The total number of laboratory confirmed human cases since 2004 now reaches 291, including 172 mortalities at the date of writing [9]. The risk of generation of a new pandemic strain either by reassortment with circulating human influenza or by direct adaptation to humans is a threat for public health. Unexpected infection of wild felines, cats and even dogs further illustrates the unusual cross-species transmission potential of this H5N1 outbreak [10].

Due to the high contagiousness and the extreme severity of the disease, HPAI is the only "flu" of domestic animals considered as epizootic (ex-list A of the OIE—formerly Office International des Epizooties, now World Organisation for Animal Health) [11], requiring drastic measures such as eradication for control. It has been estimated that hundreds of millions of birds have been culled so far in attempt to control the spread of the Asiatic H5N1 virus. Although the total number of poultry affected by this HPAI still represents a small percentage of the total world

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