



## Review Article

# DIVA Vaccines: A Brief Review on its Novel Facets for the Eradication of Infections of Livestock and Poultry

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### ABSTRACT

DIVA vaccines also known as Differentiating Infected from Vaccinated Animals help in the differentiation between infected and vaccinated animals. The first DIVA vaccines were known as marker vaccines. The term DIVA vaccine was coined in 1999 and the accompanying diagnostic tests were developed by J.T. van Oirschot and colleagues at the Central Veterinary Institute in Lelystad, The Netherlands [1], [2].

**Key words:** DIVA vaccines, Diseases, Eradication

### INTRODUCTION

The researchers earlier discovered that the DIVA vaccines can be used against pseudorabies (Aujeszky's disease) virus possessing the gE (glycoprotein E) gene having deletions in the viral genome [3]. ELISA test was developed against the monoclonal antibodies that are produced against the deletion. The ELISA helped in the demonstration of antibodies against gE. In addition, novel gE-negative vaccines were constructed by genetic engineering. Following the same principle, DIVA vaccines and companion diagnostic tests were formulated against bovine herpesvirus 1 (BHV-1) infections [2 - 4].

DIVA vaccines have the property of possessing at least one epitope less than the circulating microorganisms in the field. A diagnostic test should also accompany along with the use of DIVA vaccines for detection of antibodies against the epitope thereby allowing to make the precise differentiation [5].

### USE OF DIVA VACCINES FOR DISEASE CONTROL AND ERADICATION

The prophylactic use of vaccines against exotic viral infections in production animals was exclusively carried out in regions where the disease concerned was endemic. The DIVA vaccines allows for vaccination while still retaining the possibility of serological surveillance for the presence of infection [5 - 7]. Uttenthal et al. [8] reviewed the current knowledge on the use of DIVA diagnostic strategies for three important transboundary animal diseases: foot-and-mouth disease in cloven-hoofed animals, classical swine fever in pigs and avian influenza in poultry.

Capua et al. [9] reported on the development and validation of a control strategy for avian influenza infections in poultry. The "DIVA" strategy is based on the use of an inactivated oil emulsion vaccine containing the same haemagglutinin (H) subtype as the challenge virus, but a different neuraminidase (N). Capua et al. [9] explored on the possibility of using the heterologous N subtype to differentiate between vaccinated and naturally infected birds through the development of an "ad hoc" serological test based on the detection of specific anti-N1 antibodies. This was achieved using a baculovirus expressing a recombinant N1 protein. The A/ck/Pakistan/H7N3 virus was used as a vaccine and birds were challenged with the HPAI A/ty/Italy/4580/V99/H7N1 strain. The homologous H group ensured a clinical protection of 93% regardless of the vaccination scheme used and was able to prevent viraemia and muscle colonization in the clinically healthy challenged birds. However, it was not able to prevent viral shedding.

The "ad hoc" serological assay was developed as an indirect immunofluorescence test, and was validated using 608 field sera, and showed an "almost perfect agreement" (Kappa value) with the HI test, with relative sensitivity and specificity values of 98.1 and 95.7, respectively. The results of the present investigation suggest that the DIVA control strategy may represent a tool for the control of avian influenza infections in poultry.

#### EXPERIMENTAL DIVA VACCINES UNDER RESEARCH

Currently, scientific research is in progress against many infectious diseases, such as, Salmonella infections in pigs, avian influenza [5], classical swine fever [6] and *Actinobacillus pleuropneumoniae* [7].

#### SUMMARY

The use of DIVA vaccine has been convincingly used in many countries for the successful eradication of pseudorabies infection. This was achieved by intensively vaccinating susceptible swine populations followed by its monitoring by the companion diagnostic test with the removal of the infected pigs from the population. Use of DIVA vaccines against BHV-1 is also widely used in practice.

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