Avian Vaccination

Current Options and Strategies

J. Jill Heatley, DVM, MS, DABVP (Avian, Reptilian, Amphibian), DACZM, Susan Payne, PhD, Ian Tizard, BVMS, PhD, DACVM, DSc*

KEYWORDS

• Parrot • Immunization • Pet • Zoo • Vaccine • Disease prevention

KEY POINTS

- Most vaccines used in nonpoultry avian species are used in an off-label manner.
- The number of vaccines experimentally investigated and found efficacious in protecting birds from disease far outstrips the number of vaccines commercially available.
- There is a lack of commercially available, efficacious, and safe vaccines for the prevention of many threatening diseases in pet and nonpoultry avian species.
- Unless significant changes occur in the economics of vaccine production, including development, manufacture, and distribution, this trend is unlikely to change in the foreseeable future.
- Major differences in avian medicine and biology that contribute to the difficulty in creating and marketing of vaccines include the development of the avian immune system, continuing changes in popularity of pet bird species, and decreasing pet bird populations.

INTRODUCTION

Infectious viral diseases remain a constant threat to wild, exotic, and pet birds. Polyoma, herpes, and the Bornaviruses present a significant threat to some species and effective safe vaccines are urgently needed. Others, such as avian influenza and Newcastle disease, are potential threats to pet birds for which vaccines may be necessary in future. In general, these threats stem mainly from viral infections; however, clostridial and mycoplasmal infections are examples of bacterial diseases that are likely better prevented or avoided than treated.

The commercial production and applied use of avian viral vaccines has not kept pace with the research into the development of new and improved vaccines. Constraints on new vaccine production and marketing include not only the cost and

Disclosure: The authors have nothing to disclose.

Veterinary Pathobiology, Schubot Exotic Bird Health Center, College of Veterinary, Medicine & Biomedical Sciences, Texas A&M University, 668 Raymond Stotzer Parkway, VIDI Building 1813, College Station, TX 77843-4467, USA
* Corresponding author.
E-mail address: itizard@cvm.tamu.edu

Vet Clin Exot Anim 21 (2018) 379–397
https://doi.org/10.1016/j.cvex.2018.01.010 **vetexotic.theclinics.com**

complexity of production but also the small size of the market, especially for pet and exotic birds. Although veterinarians have been highly successful in promoting the routine vaccination of puppies and kittens, they have not yet been able to promote a similar coverage in pet birds. The relative complexity of many new vaccines, and their expensive and complex licensing requirements, are reflected in their cost. Thus a gap exists between clinicians' ability to make sophisticated vaccines in a laboratory setting and to manufacture and market these products at a reasonable price. As a result, companies are reluctant to make a large investment in new vaccine production. In contrast, chickens constitute the largest population of pet birds in the United States and waterfowl collections are widespread, which suggest that veterinarians must be prepared to use commercial poultry and duck vaccines in these species.

MODERN VACCINE TECHNOLOGY

Traditional vaccines were of 2 basic sorts: killed vaccines and modified live vaccines. Modern molecular techniques have greatly expanded the potential diversity, potency, and safety of vaccines. For example, cloning of viral antigens within bacteria and yeasts can create large quantities of very pure antigens. Irreversible attenuation of a virulent virus can be accomplished by deliberate, specific gene deletions. Incorporation of new or unusual antigens into such vaccines can also result in a DIVA (differentiate infected from vaccinated animals) vaccine. These vaccines have been used for avian influenza viruses (AIVs). Virus genes encoding their protein antigens can also be cloned into other viruses, which can then be used as recombinant vaccines. Recombinant vaccinia, fowlpox, and canarypox viruses have been most widely used as vectors because their large stable genomes are easy to manipulate. They express large amounts of antigen and their proteins undergo appropriate processing steps to facilitate antigen recognition. These live recombinant organisms are very safe. They are not secreted in body fluids or transmitted by arthropods and cannot revert to virulence. An additional benefit of canarypox-vectored vaccines is that they may overcome blocking by maternal antibodies and can thus prime very young animals. Examples of successful vaccines using this technology include Newcastle disease vaccine vectored by fowlpox virus, and the use of a yellow fever viral chimera to protect against West Nile virus (WNV).

Oral vaccination has long been considered a desirable route of vaccine administration but has been hindered by the digestion and destruction of oral antigens within the gastrointestinal tract. Cloning of vaccine antigen genes into tobacco, potato, soybean, rice, and corn has been achieved for viruses such as transmissible gastroenteritis, Norwalk virus, and Newcastle disease. A Newcastle disease vaccine produced in suspension-cultured tobacco cells has been licensed in the United States. As an alternative, vaccine antigens derived from recombinant yeasts seem to be very safe and effective.

DNA VACCINES

Instead of using protein antigens, DNA encoding specific vaccine antigens may also be inserted into a bacterial plasmid (a piece of circular DNA that acts as a vector) for use in vaccines. The plasmid, unlike viral vectors, cannot replicate but its encoded products are processed by the immune system so that they generate neutralizing antibodies as well as cytotoxic T cells. They have yet to reach commercial production but DNA vaccines are ideal for organisms that are difficult or dangerous to grow in the laboratory. DNA vaccines are often more effective than recombinant proteins and avoid the need for complex carrier organisms.