Practical Foal Vaccination Strategies

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Both passive and active vaccination regimens are important in foals. The active vaccination of foals should be initiated when maternal antibody wanes. However, even intensive vaccination regimens can generate disappointing responses in the foals' first year of life. New vaccination strategies may help overcome the difficulties in vaccinating foals. Author's address: School of Veterinary Medicine, University of Wisconsin, 2015 Linden Dr. West, Madison, WI 53706. © 1997 AAEP.

1. Introduction

Foal immunization is only one component of an infectious disease prevention program, but it remains a contentious issue with considerable debate over what products should be used and when. Currently the majority of vaccines offer only limited protection for the highly susceptible equine neonate, and therefore attention must be paid to decreasing exposure to pathogens (isolation and sanitation) and eliminating stressors that reduce the foal's resistance. This presentation concentrates on ways of increasing the foal's resistance to infection by passive or active immunization. Factors that affect a foal immunization program include management situation, geographic location, and risk versus cost benefits for the owner. Although it is impossible to make universal recommendations for the vaccination of foals, a rational plan can be developed if the key decision points in passive or active immunization regimes are understood. Two recent publications authored by Wilson and others1,2 provide a detailed discussion of current vaccination practices. Recommendations are made for vaccination strategies for different management situations, together with descriptions of commercially available products in one of the articles. Given the thorough preparation, wide availability, and recent publication date of these publications, the information is not repeated here. However, there are some specific considerations in foal vaccination strategies that are discussed.

2. Passive Immunization

Passive immunity is best understood by equine clinicians in terms of the necessity for foals to ingest adequate colostrum in the first hours of life.3 This is, of course, a massive and essential passive immunization, representing the transfer of specific antibodies to an array of pathogens. The value of passive transfer can be considerably influenced by vaccination of the mare in order to maximize colostral concentrations of antibodies to key pathogens as described below. All mares should receive booster vaccinations 4–6 weeks before parturition, using only killed (inactivated) agents. Typically this includes vaccinations for tetanus, encephalomyelitis viruses, influenza virus, and rhinopneumonitis virus, with additional vaccinations for Streptococcus equi, Potomac Horse Fever, and in some circumstances botulism. In previously unvaccinated mares, an initial vaccination course should be administered with the last booster given 4–6 weeks before
foaling. Recently a rotavirus vaccine for boosting maternal passive transfer of immunity has received a limited license by the USDA. At the time of this writing, the only state that has approved its use is Kentucky. The vaccine is administered 90, 60, and 30 days before parturition in order to maximize colostral antibodies. Initial field trials in the past 2 years have not demonstrated the product to be consistently effective in reducing diarrhea outbreaks, but further evaluations are under way. It is important to remember that the value of colostral transfer of passive immunity can also be considerably increased if the mare is housed on the farm where she is going to foal for 6–8 weeks before parturition. This allows adequate time for the generation of immune responses to pathogens present on the farm and the subsequent transfer of these antibodies into the colostrum. One general rule is that modified live vaccines (MLV’s) are not given during pregnancy. Remember that an MLV will induce some type of infection itself in order to achieve immunization. Whatever the agent, this may lead to an increased risk of abortion, and in the case of abortigenic agents such as equine herpesvirus 1 (EHV-1), the risk may be high.

Passive immunization of foals is also achieved by the oral administration of immunoglobulin-containing products to foals in the first hours of life, or by parenteral administration at any time. It is a relatively common practice to administer tetanus antitoxin to neonatal foals. However, this provides relatively short-lived protection and carries the risk of inducing serum sickness in the foal. This policy is unnecessary if the mare is appropriately vaccinated during pregnancy. One injectable product that has shown considerable promise in recent years is hyperimmune plasma from donor horses vaccinated against Rhodococcus equi. This therapy has shown value for preventing outbreaks of R. equi infection in foals when used prophylactically, although it has no therapeutic value in the face of actual disease. In one field trial, foals given hyperimmune plasma had a significant decrease (p < 0.001) in R. equi infections (2.9%) versus non-treated foals (43%). The plasma-derived R. equi antibodies maintained significant levels for 60 days after transfusion, which can potentially protect foals throughout their period of susceptibility. The exact age at which foals should be given R. equi hyperimmune plasma is not well defined, but administration in the first week of life has proven effective and the epidemiology of the disease suggests that it should at least be given in the first 30 days. Although costly and troublesome to administer, R. equi hyperimmune plasma therapy should be considered for foals on farms where R. equi is an endemic problem. It is hoped that in the future, R. equi vaccines that can be given to pregnant mares to effectively boost colostral immunity will be developed. To date, vaccination of mares for R. equi has failed to protect foals, but the recent identification of a virulence-associated protein specific to pathogenic strains of R. equi may provide new opportunities for developing effective maternal vaccines. The issue of passive and active immunization against R. equi infection is reviewed in greater detail elsewhere in these proceedings.

The administration of plasma transfusions to foals suffering from failure of passive transfer is a common procedure for equine clinicians, and it offers an opportunity to influence resistance to specific pathogens through the choice of product. Commercial equine plasma products should be chosen that have been prepared from donors extensively vaccinated against common equine pathogens. In addition, several commercial plasma producers hyperimmunize donors against R. equi as described above, and against the endotoxin produced by gram-negative bacteria. Although it is not proven that antiendotoxin antibodies administered in this way can prevent or attenuate the effects of endotoxemia or gram-negative septicemia in foals, the selection of a plasma product containing these antibodies may offer some advantages when failure of passive transfer is treated.

3. Timing of Foal Vaccinations

A contentious issue in foal vaccination is the timing of the initial series of vaccinations. The problem largely results from the immunosuppressive effects of maternal antibodies, and their variable half-life. As in many veterinary species, in the foal it is difficult to time these initial vaccinations so that they are effective and yet are still administered early enough so as not to leave the young animal unprotected after the waning of maternal antibodies. An additional consideration is the increasing perception that foals may be relatively immunologically unresponsive to many of the currently available vaccines.

The first step in determining when to start a foal vaccination regime is knowing the duration of maternally derived antibodies. The rate of decline of maternal antibodies varies for both individuals and different infectious agents. For many important pathogens, the concentration of maternal antibodies in foals falls to nonprotective levels by 2–3 months of age. However, the remaining antibody can still render the foal unresponsive to vaccination for weeks or even months to come. In the case of equine influenza virus infection, maternal antibodies can persist until 6 months of age and prevent immune responses in foals vaccinated prior to reaching that age. For this reason the American Association of Equine Practitioners currently recommends beginning foal vaccinations at 3–4 months of age followed by one to two boosters at 4-week intervals. For many foals this is adequate, but a significant number of foals in a high-risk management situation may remain vulnerable to infections. A more intensive vaccination schedule would include an initial vaccination at 2 months of age and monthly boosters until 6 months of age, with further boosters at 9 and 12. 
months of age. In the case of tetanus and rabies, an initial vaccination at 3–4 months and a booster 4 weeks later should be adequate.

Even when intensive vaccination regimes are employed in young foals, poor responses can still be observed. This may be a result of a relative lack of immune responsiveness in young foals to currently available vaccines, but an alternative proposal is that the frequent use of vaccines in the face of persistent maternal immunity may actually induce a state of tolerance, which can prevent a satisfactory response to vaccines past 1 year of age. This observation was made in regard to the frequent use of influenza vaccines, and it led one investigator to suggest that initial vaccines may actually have to be delayed until 6 months of age. Similar findings have been reported in a study of eastern equine encephalomyelitis vaccination of foals. While the reasons for the limitations of current vaccination strategies are still being defined, it is apparent that new vaccines using more potent adjuvant systems, alternative routes of administration, or modified live products have to be developed.

4. Product Choice
Currently available vaccines include many highly efficacious products that are safe, provide long-term immunity, and are practical to use. Current clostridial vaccines are a good example. However, killed or inactivated products have limitations in terms of the types of immune response they can induce (see the article on page 49). Although the persistent use of these types of products will induce protective immunity to pathogens such as influenza virus, these responses are particularly difficult to generate in foals. In making choices between products, one must consider both the antigen contained in the vaccine and the means of delivery. For example, in the case of equine influenza vaccines, it is important to look for an equine influenza type 2 strain with a date from the late 1980’s or ideally the 1990’s. This will increase the likelihood that the vaccine will protect against currently circulating strains of influenza virus. Similarly in the case of EHV vaccines, it is important to include both EHV-1 and EHV-4 antigens for protection against both abortion and respiratory disease. One important issue that can affect vaccine efficacy is the quantity and purity of the pathogen antigens present in the product. This information is rarely available to veterinarians, and therefore choices are made on the basis of reports of clinical efficacy and the reliability of the manufacturer. Ideally a product should be selected that is known to cause a low incidence of injection reactions.

The type of adjuvant contained in inactivated vaccines is a critical issue for efficacy. A key issue in vaccine development is the ability of different adjuvants to stimulate specific T-cell subsets that control the major features of specific immune responses. One example of this trend is the development of the powerful immune stimulating complex (ISCOM)-adjuvanted equine influenza vaccines currently used in Europe. There is already evidence of the efficacy of influenza virus ISCOM vaccines in horses, and a commercial equine influenza virus ISCOM vaccine has been available for several years in Sweden and more recently in Great Britain. Protective immunity lasting as long as 15 months after vaccination of horses has been reported.

Typically, MLV’s are among the most effective vaccines. However, MLV’s are only available for use in horses against a limited number of agents (e.g., EHV-1 and equine viral arteritis) and have their own disadvantages. Nevertheless, MLV’s should be considered for use in equine vaccination regimes when practical given their capacity to induce protective immunity, and it is very likely that new equine MLV’s will appear on the market in the next few years. Unfortunately it is also likely that they may not be labeled for use in foals. This is due to the practical and financial difficulties in complying with FDA requirements for labeling new products, and particularly MLV’s, for use in animals in this age group.

References and Footnotes
13. van Maanen C, Bruin G, de Boer Luijtieze E, et al. Interference of maternal antibodies with the immune response of


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