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Importance of Antirabies Revaccination for an Adequate Antirabies Protection in Bovine Newborns▽

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The transfer of antirabies immunoglobulins in cows that were prime vaccinated and cows that were revaccinated against rabies correlated to the serum titers in their offspring was evaluated. The results demonstrated that revaccination against rabies during pregnancy induces neutralizing antibody titers at a protective level that are transferred directly to calves through colostrum and reinforce the importance of revaccination for improved colostral antibody transfer and offspring protection against rabies.

According to the Panamerican Health Organization (16), 2,797 cases of rabies in cattle were reported in 2004 in the Americas, which is an 87% increase over 2002 levels. Of these, 2,591 (92.6%) occurred in Latin America and 130 (4.6%) in North America. In Latin America, Brazil had 60.6% of the cases, followed by 13% in Mexico and 8% in the Andes. More recent data demonstrated that Brazil still reports more cases of rabies in domestic animals than other countries of South America, with a predominance of rabies in cattle (24).

There is no predisposition by race, sex, or age to contracting rabies, but a greater prevalence of the disease can be observed in young animals (10). The occurrence of numerous cases of rabies in calves less than 1 year of age may be related to the lack of colostral immunity and the fact that the animals have not been vaccinated against rabies yet, or if they have, most have not received the vaccine booster (11, 14).

A higher prevalence of rabies in young animals which had not been revaccinated 30 days after the first vaccination was reported (10, 12, 14). The importance of a booster dose was also reported by several researchers (1, 2, 17, 20, 21, 23), confirming that the immune response induced by only one vaccine dose does not induce high antibody titers. However, when boosters are given, the serum neutralizing antibody titers become significantly higher (1, 16). The presence of serum neutralizing antibodies in cattle vaccinated against rabies is a good indicator of the effectiveness of the vaccine (3).

Compared with active immunity described above, passive immunity is transferred through colostrum to calves after birth and has a limited duration. It has been verified that the passive immunity induced by colostrum is detected for a relatively short period, while immunity actively induced by vaccination is in many cases more lasting. The newborn ungulates have initial protection achieved by passive transfer of immunoglobulin (Ig) from mother to newborn (20). The transfer of the maternal antibodies to the fetus is determined by the structure of the placenta. The placenta of ruminants is syndesmochorial. This type of placenta prevents the passage of Ig molecules to the fetus, making newborns dependent on antibodies received through colostrum (5, 7).

In cattle, it is essential that the calves ingest colostrum until 24 h after birth (5). Failure of appropriate colostral antibody transfer can occur due to situations such as insufficient quantity or poor quality of colostrum production, low volume of ingested colostrum, low Ig concentration in the colostrum, or age at first pregnancy of the cow and weight of calf at birth (6, 7). The acquisition of passive immunity in neonates is dependent on the ingestion and absorption of appropriate quantities of Ig from colostrum, which is essential to provide protection for the first 2 to 4 weeks of life (6, 19).

One of the biggest challenges in the development of an active immune response in calves has been assigned to maternal immunity to interference. When the vaccine in large animals is delineated, a large variability in the persistence of maternal antibodies is usually observed. One important factor in maternal antibody persistence is the level of maternal antibodies in serum (14).

The objective of this work was to evaluate the transfer of antirabies immunoglobulins from dams that were prime vaccinated and revaccinated against rabies to determine the correlation to the serum titers in their offspring 48 h after birth. Thirty pregnant, Nelore breed females that were not vaccinated and 30 previously vaccinated against rabies with the same type of antirabies vaccine 1 year before were vaccinated with 2 ml of a PV strain inactivated antirabies vaccine (Rabivac-Pfizer Inc.), during the final third of pregnancy. At 48 h after parturition, blood from 30 prime-vaccinated and 30 revaccinated dams and 60 offspring was collected, and the serum neutralizing antibody (SNA) titers were analyzed by a rapid focus fluorescent inhibition test (RFFIT) using serial dilutions 1:10 to 1:640 of serum samples and positive and negative serum controls in microplates. The plates were stained with fluorescein isothiocyanate (FITC)-labeled antirabies immunoglobulin (rabies conjugate; Fujirebio) and the titer of a standard reference serum diluted was determined in each test (8, 22). The conventionally defined SNA titer of 0.5 IU/ml for humans was considered a cutoff for rabies immunization (1). The results for the titers from cows that were prime vaccinated and those that were revaccinated were evaluated comparatively and corre-

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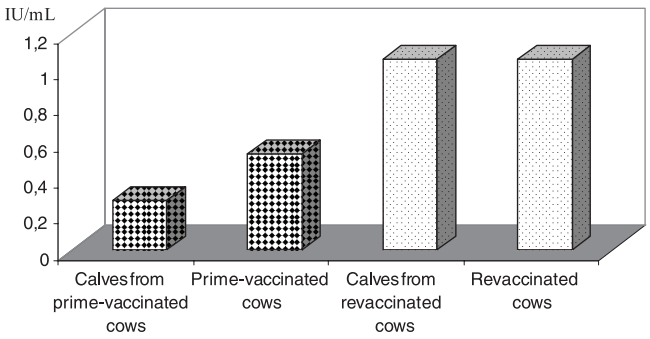

FIG. 1. Median of serum neutralizing antibody titers, 48 h after parturition, in cows prime vaccinated and revaccinated against rabies and their offspring 48 h after birth.

lated to the serum neutralizing titers presented by their calves by nonparametric statistics (Mann-Whitney test; $P < 0.05$) (Instat software).

The medians and standard deviations of SNA titers, 48 h after birth, were 0.27 ± 0.14 IU/ml and 1.06 ± 0.09 IU/ml in calves from vaccinated and revaccinated mothers, respectively, and 0.53 ± 0.23 IU/ml and 1.06 ± 0.15 IU/ml from the vaccinated and revaccinated mothers, respectively, at the same moment.

The results showed the presence of serum neutralizing antibody titers higher than 0.5 IU/ml 48 h after the birth of the calves from all revaccinated cows. There was a statistically significant difference between the antirabies antibody titers for cows that were prime vaccinated and those for revaccinated cows ($P < 0.001$), as well as for the calves born from prime-vaccinated cows and those for the revaccinated ones ($P < 0.001$) (Fig. 1). Different results were obtained by Geronutti (9), who studied cows that were prime vaccinated against rabies in the final period of gestation. Geronutti reported the absence of protecting titers in 9 of 30 (30.0%) cows that were evaluated after the birth of their calves. Geronutti thought that the lack of protective titers could be due to a possible vaccination failure because only a single dose of vaccine was used. This is in agreement with the work carried out by Albas et al. (1), who demonstrated the need of a booster to induce persistent antibody titers in vaccinated animals.

Other researchers have also reported similar results (17, 20, 21, 23), demonstrating that the immune response induced by only one vaccine did not induce high antibody titers; however, when boosters are given, titers become significantly higher (1, 2, 15).

In our study, 48 h after birth and colostrum ingestion, similar or even higher antibody titers were observed in calves, compared to titers of their respective mothers ($P > 0.05$), indicating the transfer of colostral antibodies in all lots of animals studied. These results are contrary to those of Bunn (4) and Geronutti (9), who observed that when assessing the transfer of colostral antibodies in calves born from prime-vaccinated cows, the titer of the calves was significantly lower and did not correlate with the mother's titer after birth.

Antirabies antibody titers from birth until 4 months were observed in all lots of calves studied in this work. The persistence of antibodies acquired passively by colostrum is in disagreement with the findings of Geronutti (9), who found antibody titers from 30 days to 60 days of age in calves born from prime-vaccinated cows. This reinforces the need for maternal revaccination for adequate immune transfer through colostrum to the offspring.

These results demonstrate that revaccination against rabies during pregnancy induces neutralizing antibody titers at a protective level that are transferred directly to calves through colostrum. These antibodies remain for a variable period of 3 to 4 months in calves born from cows that were revaccinated during pregnancy, compared to mothers that were not revaccinated that presented and transferred lower and less persistent antibody titers to their calves.

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