Importance of antirabies revaccination for adequate antirabies protection in bovine newborns

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Abstract

The transfer of antirabies immunoglobulins in cows that were prime-vaccinated and cows that were revaccinated against rabies correlated to the sera titers in their offspring were 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.

Key Words: rabies, vaccination, newborns, colostral antibodies, humoral immunity, cattle
Introduction

According to the Panamerican Health Organization (15), 2797 cases of rabies in cattle were reported in 2004 in the Americas, which is an 87% increase from 2002. Of these, 2591 (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 number of rabies in domestic animals that other countries of South America with predominance of rabies in cattle (24).

There is no predisposition of 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 one 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 re-vaccinated 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 and 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 hours after birth. 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, 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 two to four 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, it should be remarked that there is a large variability in the persistence of maternal antibodies. One important factor in maternal antibodies 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 sera titers in their offspring 48 hours after birth. Thirty pregnant, Nelore breed females, that were not vaccinated and thirty previously vaccinated against rabies with the same type of antirabies vaccine one year before, were vaccinated with 2mL of a PV strain inactivated antirabies vaccine (Rabivac®-Pfizer Inc), during the final third of pregnancy. Forty eight hours after parturition, blood from 30 prime-vaccinated and 30 revaccinated dams and 60 offspring were collected, and the sera neutralizing antibodies (SNA) titers were analyzed by Rapid Focus Fluorescent Inhibition Test (RFFIT) using serial dilutions 1:10 to 1:640 of serum samples and positive and negative sera controls in microplates. The plates were stained with FITC-labelled 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 cut-off for rabies immunization (1). The results were evaluated comparatively between the titers of cows that were prime-vaccinated and revaccinated and correlated to the serum neutralizing titers presented by their calves by non parametric statistics Mann-Whitney Test considering p<0.05 (Instat software).

The median and standard deviation of SNA titers, 48 hours after birth, in calves from vaccinated and revaccinated mothers were, respectively, 0,27 ± 0,14 UI/mL and 1,06 ± 0,09 UI/mL and from the vaccinated and revaccinated mothers, respectively, 0,53 ± 0,23 UI/mL and 1,06 ± 0,15 UI/mL at the same moment.

The results showed the presence of serum neutralizing antibodies titers higher than 0.5 UI/mL 48 hours after the birth of the calves from all revaccinated cows. There was a statistically significant difference between the antirabies antibody titers in cows...
that were prime-vaccinated compared to revaccinated cows (p<0.001), as well as for
the calves born from prime-vaccinated cows compared to 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. The author reported the
absence of protecting titers in 9 (35.7%) of 30 cows that were evaluated after the birth
of their calves. The authors 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 hours after birth and colostrum ingestion, similar or even higher
antibody titers were observed in calves, as 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 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 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 three to four months in calves born from cows that were revaccinated during pregnancy, as compared to mothers that were not revaccinated that presented and transferred lower and less persistent antibody titers to their calves.

Bibliographic references


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