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ARTICLE

Rabies Vaccination and Immune Status of Owned Dogs in Zaria, Nigeria

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SUMMARY

Rabies prevention in both humans and animals is possible by vaccination. The domestic dog (Canis familiaris) is the major reservoir in rabies-endemic Asia and Africa. Vaccination of dogs remains the most cost-effective option for rabies control in these regions and herd immunity is achievable when up to 70% of dogs in a community are immunised against the disease. This study was carried out to determine the vaccination and immune status of owned dogs in Zaria. A total of 189 serum samples were collected from dogs in Zaria. Accompanying information obtained included the vaccination status of the dogs, sex, location and management system. Serum samples were stored at -20°C until shipped on dry ice to the rabies laboratory of the CDC, Atlanta Georgia. The samples were tested for virus neutralising antibodies by the rapid fluorescence focus inhibition test (RFFIT) using the challenge virus standard (CVS-11 strain). Only 32 (16.9%) of the dogs in this study had a history of vaccination and out of this number, 23 (71.9%) had virus neutralizing antibodies (VNA) to CVS-11. Five dogs reportedly vaccinated had no demonstrable VNA and 20 (14.8%) had VNA even though they were said to be unvaccinated by their owners. Dogs are kept with no collars or vaccination certificates and tags, so it was difficult to verify the claims by some of the dog owners. The results of the study indicate very low vaccination coverage, but appreciable sero-conversion rate among vaccinees. Vaccination of dogs is still a viable option for rabies control in rabies-endemic areas and mass vaccination of dogs should be encouraged if the disease is to be controlled in rabies-endemic areas.

KEYWORDS: Dogs, Rabies Vaccination, Immune status, Zaria, Nigeria.

INTRODUCTION

Rabies is a serious viral zoonosis that is responsible for over 50,000 human mortalities annually worldwide. These mortalities occur mainly in the developing world, especially in Asia (56%) and Africa (44%) (WHO,2005). Over 99% of human exposures to rabies result from the bite of the domestic dog, *Canis familiaris*. The dog population is increasing and poor dog ownership practices prevail.(Adaba *et al*., 2004) Most dogs are not vaccinated against vaccine-preventable diseases including rabies.(Ahmed *et al*., 2000) In many instances, the management system is very poor and dogs are allowed to roam and search for food and shelter. This practice results in many cases of dog bite, potentially exposing humans to rabies. Voluntary vaccination of dogs is declining and where dogs are vaccinated, it is difficult to ascertain if immunity has been conferred and the dogs sufficiently protected since many do not have proof of vaccination such as collar tags and vaccination certificates There are in addition, problems of maintaining the cold chain with the incessant power failure, handling and even how genuine the sources of the vaccines being used in Nigeria are. The WHO recommends that about 70% of dogs need to be vaccinated to control rabies in a community (WHO, 1989; Knobel *et al*., 2007). It is not enough just to vaccinate individual dogs, rather, the efficiency of the vaccines evidenced by sero-conversion need to be monitored. It is possible to estimate the vaccine efficiency by serological tests for specific antibodies to lyssaviruses (Trimarchi and Nadin-Davis, 2007). This can also indicate disease prevalence in endemic areas (Dzikwi *et al*., 2010a; 2010b. This study was carried out to determine the prevalence of virus neutralizing antibodies (VNA) to rabies in dogs and what proportion of "vaccinated" dogs are actually immunised.

MATERIALS AND METHODS

Study area, sample collection and storage

One hundred and eighty nine serum samples were collected from apparently healthy dogs in Zaria. The study sites included Samaru (old and new extensions, Danraka, and Hayin- Danyaro), Sabon Gari (Hayin- Ojo), and Ahmadu Bello University Staff Quarters (Area 3, Quarter 2,

Areas C, F, and G). Consent was sought from the ward heads where applicable and dog owners that consented to the study were included. Selection of dogs for the study was by convenience sampling. Visits were made to various sampling sites and homes that own dogs were identified. An adult member of each household was interviewed and a questionnaire filled out. Information obtained included age, sex, and vaccination history of the dogs. Approximately 5mls of blood was collected from the cephalic vein and serum separated. The serum samples were stored in appropriately labeled bottles at -20°C in the Viral Zoonoses Laboratory of the Veterinary Public Health and Preventive Medicine, Ahmadu Bello University Zaria. Samples were afterwards shipped (according to the international standards for the transportation of infectious agents, Category A) on dry ice to the Rabies Laboratory of the Centers for Disease Control and Prevention (CDC) for analysis.

Rapid fluorescent focus inhibition test (RFFIT) for virus neutralising antibodies

The rapid fluorescent focus inhibition test (RFFIT) was used for testing of sera for neutralizing antibodies to rabies virus (RABV), using the Challenge Standard Virus strain (CVS-11 from South Africa, 1998). The analyses were performed according to the Standard Operating Procedure (CDC RFFIT SOP, 2006).

The U.S standard rabies immunoglobulin (National Institute for Biological Standards and Control, Herts, EN6 3QH, UK) with a pre-determined unit value giving 2 IU/ml was used as a reference serum standard for this test.

RESULTS AND DISCUSSION

Only 32 out of the total of 189 (16.9%) dogs surveyed had a previous history of vaccination against rabies. Of the 32 dogs with vaccination history, 23 (71.9%) had neutralizing antibodies to rabies virus (genotype 1). Five dogs that were said to be vaccinated had no VNA. Twenty eight dogs (14.8%) had antibodies even though they were reportedly unvaccinated.

From the results of this study, only about 17% of dogs sampled had a history of vaccination. The overall figure of vaccinated dogs is below the recommended minimum of 70% of dog population that should be immunised in order to achieve herd immunity (WHO, 1989). In a study in Ibadan, records of voluntary vaccination of dogs dropped from 37% as at 1992 to just about 11% by 2002 (Adeyemi and Zessin, 2000; Adeyemi *et al*., 2005). This low trend of vaccination coverage is also reflected in this study, with only 17% of the dogs being vaccinated. The relative high cost of vaccines and other reasons attributable to poor utilisation of veterinary services such as distance from veterinary clinics, low level of awareness about the dangers of not vaccinating their pets against rabies, and poor veterinary services (Adaba *et al*., 2004) may be contributory to the low level of vaccination coverage.

Of the total 189 dogs sampled, only 12.2% were protected as evidenced by the presence of VNA. Of the dogs with a history of vaccination, 72% were confirmed to have virus neutralisation antibodies to CVS-11. It then implies that if all dogs are vaccinated properly, about 72% will be protected and rabies can be prevented by herd immunity. This fact is however based on some assumptions such as equal exposure to infection, i.e. assuming that infected and susceptible individuals are properly mixed (Anderson and May, 1991). This may not necessarily be the case as dynamics of dog population in this area is not well studied.

Dogs exist in subpopulations, where one category may consist of fully confined and therefore, not likely to mix with other dogs, reducing the likelihood of getting exposed to rabid dogs. This same category is the one that is likely to be vaccinated. The other categories of unconfined or partially confined dogs are more likely to mix with infected and other susceptible dogs (Knobel *et al*., 2007). In Tanzania, it was demonstrated that 60-80% vaccination coverage reduced dog rabies incidence and human exposure significantly (Cleaveland *et al*., 2003). Similarly, mass dog vaccination in Thailand reduced human deaths from rabies to zero between 1999 and 2001 (Kamoltham *et al*., 2003)

Five dogs that had a history of vaccination did not have neutralising antibodies. It is possible that the dogs were vaccinated but had not sero-converted yet at the time of sampling. Another

possible explanation may be that they were actually not vaccinated, but were reported to be vaccinated by their owners for fear of being reprimanded, or that the vaccine used was not effective either because of poor handling and failure to maintain cold chain or for some other reasons that might have rendered the vaccine non-efficacious (Oladokun *et al*., 2010).

Another group of 28 dogs without a history of vaccination had VNA to CVS-11. This accounts for 14.8% of the dogs sampled. A similar report of presence of VNA in previously unvaccinated dogs exists in which up to 30.7% of the dogs sampled had VNA (Ogunkoya *et al*., 1990). It is possible that some of the dogs were vaccinated previously, but reported as not vaccinated as a result of a long duration from date of last vaccination or had changed ownership and the new owners did not know the actual vaccination status of the dogs. Most dogs have neither vaccination certificates nor tags. There is no other means by which their vaccination status could be ascertained. Other possible explanations could be that inapparent lyssavirus infection exists, or that rabies is not necessarily fatal or that there are other less virulent strains of lyssaviruses circulating in this region (Ruesegger *et al*., 1961).

In a study in Tanzania, only 33% of households of dog bite victims were able to afford the cost of post exposure prophylaxis from their family savings (Kaare, 2007). The balance of required funds was sought from selling properties, livestock or borrowing money.

Vaccination as a tool for rabies control can be effective if it is well planned and executed. Dog vaccination still remains a cost effective option for rabies control especially since post exposure prophylaxis in humans is much more expensive and the prevailing economic circumstances in many instances in developing countries may not permit access to the full recommended regimen. Ensuring mass vaccination of dogs is promising for rabies control in Nigeria, since sero-conversion has been demonstrated by majority of the vaccinated dogs in this study.

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