Paper

Feasibility of canine oral rabies vaccination in Sri Lanka - a preliminary report

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Abstract

Objective To test the feasibility of introducing oral rabies vaccine (vaccinia recombinant rabies glycoprotein) to improve domestic dog immunisation coverage in a selected area.

Design A prospective field trial.

Setting Panadura, an area relatively isolated by waterways, making it a suitable field laboratory.

Methods A routine parenteral vaccination program was carried out. A house to house survey identified the residual non-vaccinated dogs in the selected area. Oral vaccine was offered to the non-vaccinated domestic dogs.

Results Of 4322 dogs in the households, 1242 dogs (28.7%) were eligible for oral vaccine. 659 (53%) were considered to have accepted the oral vaccine with release of the vaccine in the oral cavity.

Conclusion It is feasible to use oral rabies vaccine to enhance immunisation coverage.

Introduction

Although Sri Lanka's achievements in health development are held up as exemplary by international organisations such as the WHO and the World Bank (1,2) human rabies remains a significant public health problem (Table 1). Being an island, it should theoretically be easy to eliminate animal rabies. Dogs are the major vector, canine rabies being endemic in the country. In 1994 and 1995, 96.5% of the reported cases were due to dog bite. The majority of human victims have been adolescents and young adults (Table 2), for whom the country has invested heavily for education, health and job training.

In 1995 oral vaccinia recombinant glycoprotein was successfully used to control sylvan rabies in developed countries. Its adoption to control urban and rural canine rabies was looked upon as a challenge.

The national rabies control programe

Parenteral vaccination of domestic dogs and elimination of strays, the mainstays of the rabies elimination program in Sri Lanka for the last 25 years, have not yielded the expected reductions in human or canine rabies. Surveys done in areas where intensive programs were conducted showed that the maximum vaccination coverage reached had been 56% for the entire dog population (owned as well as stray) and 62% for the owned dogs. Some reasons for failure to vaccinate domestic dogs are given in Table 3.

Table 1. Incidence of human rabies from 1989 to 1998

1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
175	154	134	112	98	105	151	152	135	79

Table 2. Breakdown by age (% of cases) of human rabies, 1994 and 1995

1-10	11-20	21-30	31-40	41-50	51-60	61-70	>70
16.6%	19.2%	13%	7.3%	20.3%	13%	9%	1.6%

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Table 3. Reasons for failure to vaccinate domestic dogs after the campaign in Mirigama, Sri Lanka 1997

	Dogs (%)	*Households (%)*
Owner absent	9 (19.6)	9 (27.3)
Unaware of campaign	6 (13.0)	5 (15.2)
Nearest centre too far	5 (10.9)	1 (3.0)
Owner refused vaccination	4 (8.7)	4 (12.1)
Dog cannot be handled	13 (28.3)	5 (15.1)
Dog is old or sick	13 (6.5)	3 (9.1)
Bitch pregnant	3 (6.5)	3 (9.1)
Other reasons	3 (6.5)	3 (9.1)
Total	46 (100.0)	33 (100.0)

10% of the dog population is estimated to be strays. Theoretically, if 75% of the entire dog population is vaccinated, dog rabies could be eliminated. If the percentage of owned dogs vaccinated could be increased from the existing 62% to about 75%, herd immunity could be achieved among this group. The use of oral rabies vaccine is a promising option.This strategy has been tried out successfully in a number of developed countries such as South Africa, Tunisia and Turkey to control the spread of rabies in wild animals (3,4,5,6). A few developing countries (eg.Thailand) are also testing oral rabies vaccination in urban settings.

Methods

A research study was undertaken to examine the feasibility of using oral rabies vaccine to immunise domestic dogs. The study area selected was Panadura, a seaside township on the western coast. The area consists of fishing villages and urban settlements. Hotels, restaurants and a number of meat and fish stalls dot the area. The size of the area is 75 km^2, and the population density about 2700 km^2 (Medical Officer of Health, Panadura, personal communication).

The specific objectives were

1. to ascertain the vaccination coverage that could be achieved by supplementing parenteral vaccination with oral vaccination.
2. to ascertain the degree of vaccine bait acceptance.
3. to evaluate the sero-conversion of the domestic canine population after oral vaccination and to compare it with the sero-conversion after parenteral vaccination.
4. to evaluate the safety of handling oral rabies vaccine in a densely populated area.

The study was supervised by a committee set up by the Ministry of Health. Ethical approval was obtained from the ethics committee of the Faculty of Medicine Colombo.

The study consisted of several stages. A house to house survey was first carried out to ascertain the domestic dog population in the area. Blood samples (3 ml of venous blood) were taken from 120 dogs to determine baseline antibodies against rabies. The samples were taken from the groups of dogs shown in Table 4 during the course of the study.

The dogs were bled 45 days later for determination of antibody levels. Of the 120 dogs who were bled originally 96 were available for bleeding after 45 days. (drop out rate 20%). All the serological studies were done at the WHO collaborating centre Nancy, France. A code number identified the samples.

Table 4. Groups of dogs selected for serological studies

Group	*Description*	*Number of serum samples collected before vaccination*	*Number of serum samples collected 45 days after vaccination*
1	Previously vaccinated and presented for parenteral vaccination.	31	24
2	Never vaccinated and presented for parenteral vaccination.	30	20
3	Previously vaccinated and presented for oral vaccination.	26	25
4	Never vaccinated and presented for oral vaccination.	33	27

A parenteral vaccination program was carried out. A house to house survey by the trainee public health inspectors (PHIs) identified the residual non-vaccinated dogs in the selected area. The householders were briefed regarding the project. The trainee PHIs were then divided into a number of teams. Each team was given 15 to 20 vaccine baits in suitable boxes and provided with disposable gloves and spray guns with sodium hypochlorite to inactivate spilt vaccine. The bait was made of fish meal, with the vaccine containing sachet embedded.

Oral vaccine was offered to the non-vaccinated domestic dogs. The following categories were excluded from oral vaccination: puppies less than three months old, animals vaccinated during the current campaign, bitches with unweaned litters, dogs in households with immuno-compromised patients. Problems during screening were brought to the notice of a medical officer present during the field program. The fate of the vaccine bait was closely monitored. Unaccepted baits were collected with gloved hands into plastic bags and incinerated.

Monitoring was carried out after 48 hours by public health midwives among a random sample of the households with dogs given the oral rabies vaccination to determine adverse effects and exposure of human beings. Reports were obtained about 104 dogs. Not a single dog had bitten anybody. One was observed to be anorexic, and one other to have mild diarrhoea. Both recovered completely.

Reports were obtained after 14 days from the householders about the condition of dogs given oral rabies vaccination. From among 250 householders 11 reported the following symptoms: loss of appetite 2 dogs, vomiting 3, diarrhoea 1, excess salivation 3, rabies-like symptoms followed by death 1 and pustular dermatitis 1.

Special safety precautions

Trainee PHIs were given pre-exposure intradermal rabies vaccination one month before the commencement of the project. As there was a theoretical risk of accidental exposure of immunocompromised patients to the vaccinia virus, a house to house survey was done before the vaccination campaign to exclude any household with such patients. Centre for Disease Control, Atlanta was informed about the study, and requested to have a supply of antiserum for the vaccinia virus as standby. In case of necessity, they agreed to air-lift the antiserum within 24 hours. Safety precautions were taken while handling bait.

Awareness programs for the general public

A health educational programe was carried out. All participating households with dogs to be offered oral vaccination were briefed about the study through community leaders, health workers and by a pre-tested information sheet detailing safety precautions to be taken after oral rabies vaccination.

Program for doctors

The specialists and doctors in Panadura hospital and general practitioners in the area were briefed about the study and the procedure to be followed in cases of accidental exposure of human beings to the oral rabies vaccine.

Training of public health workers

All trainee public health inspectors, range public health inspectors, public health nursing sisters and family health workers were given a detailed training stressing the following points: objectives and methodology, the importance of honouring safety precautions while handling the oral vaccine, preventing environmental contamination and the steps to be taken in case of environmental contamination accidentally (places contaminated with vaccine fluid were to be immediately decontaminated with 10% sodium hypochlorite), and steps to be followed in case of accidental exposure within 48 hours to an animal vaccinated with the oral rabies vaccine.

Results

The selected 140 clusters (of 50 to 60 households) had a total of 7846 households. The human population was 31 500. There were 4322 dogs in the households. Of these, 2715 (63%) were given parenteral vaccination. 1242 dogs were eligible for oral vaccine. 659 (53%) were considered to have accepted the oral vaccine to ensure release of the vaccine in the oral cavity. The range for different villages was 37% to 75%.

One of the following conditions had to be fulfilled to ensure release of the vaccine in the dog's oral cavity; chewed the bait plus the fluid containing sachet, chewed part of the bait with the release of greater part of the vaccine as indicated by the spitting out of the empty or nearly empty sachet.

Supplementary oral rabies vaccination brought up the total vaccination coverage among domestic dogs to 78%.

Discussion

The two mainstays of the national canine rabies control program are parenteral vaccination of domestic dogs and destroying of strays. The results were unsatisfactory

and human rabies continues to be a significant public health problem. The 75% vaccination coverage required for herd immunity could not be achieved.

Elimination of strays has been an insurmountable problem in a predominantly Buddhist country, where the community abhors killing of animals. There is constant interaction between the domestic dogs (majority are usually free roaming) and the strays. The latter ensure the perpetuation of the cycle of infection among domestic dogs and is also a major vector of human rabies. Reported success of oral rabies vaccine in controlling sylvan rabies offered an alternate strategy to address both problems.

The census of dogs in the project area indicated 1 dog per 1.8 households. An overall coverage of 63% (2715 animals) was achieved by parenteral vaccination in the seven villages (range 51 % to 76%). Of the remaining 1701dogs, 459 were unsuitable for oral vaccination by the criteria given earlier. Hence oral vaccine was offered only to 1242. 80% of the dogs consumed the bait, either partially or completely, and 659 (53.1%) were considered successfully vaccinated. The range among the villages was 37% to 75%. Some of the reasons for rejection of the bait were:

1. Several houses had both pure bred and cross-bred dogs. The former accepted the bait whereas the latter did not. Cross-bred dogs are free to roam and hence have access to fish offal in this predominantly fishing area. The bait may not be attractive to them.
2. It appeared that the bait was too hard for biting.
3. Due to cold storage of the bait, the aroma had been lost.
4. Strangers offered the vaccine bait and it was noticed that some dogs were reluctant to accept food from strangers.

Safety of handling oral rabies vaccine

No issues connected to the safety of handling oral rabies vaccine came up during the research project. It is felt that the precautionary measures undertaken ensured safety. No significant adverse reactions were noticed among the dogs given oral vaccination.

Conclusions

We conclude that oral rabies vaccination can be used to achieve herd immunity among domestic dogs, and that the vaccine could be handled safely in an urban setting. There is a need to find ways to increase bait acceptance, and the next logical step would be to extend oral rabies vaccination to stray dogs.

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