

Oral vaccination of dogs against rabies as a supplementary tool to parenteral vaccination: A sustainable solution towards eradication of dog-mediated rabies.



Ad Vos,
Wouter Huizinga,
Christian Kaiser
& Peter Schuster
IDT Biologika GmbH,
Dessau-Rosslau, GERMANY

Abstract

Mass dog vaccination has proven to be the most efficient way to prevent and control dog-mediated rabies. Unfortunately, and especially in areas in the developing countries, a high number of free-roaming dogs — playing a very important role in the maintenance and transmission of rabies - are inaccessible to conventional parenteral vaccination. By offering free roaming dogs a vaccine-loaded bait that is well accepted, Oral Dog Vaccination (ODV) can be used as an effective supplementary tool to the traditional parenteral vaccination. The increase of the overall vaccination coverage to sufficiently high levels by using a combination of parenteral and oral vaccination, will interrupt the transmission cycle among dogs, and will thus shift the paradigm from annual vaccination campaigns to a sustainable solution: the eradication of dog mediated rabies. The use of oral vaccination of dogs in combination with parenteral vaccination will likely depend on the local situation. In certain areas almost all dogs can be vaccinated by the parenteral route and oral vaccination is not needed. However, in other areas most dogs can only be reached by offering these animals an oral vaccine bait.

Introduction

The core of the global rabies problem is the dog population. The majorities (95 %) of the human rabies cases are a direct result of a dog bite and account for about an estimated 59'000 death a year, mainly in developing countries, where PEP treatment is not readily available. Apart from human suffering, the global economic impact of dog-mediated rabies is estimated by the Global Alliance for Rabies Control (GARC) to be \$ 100 billion annually. Hence, from a global One Health perspective, dog rabies control has the highest priority. So far, investment in parenteral mass dog rabies vaccination has been the single most effective way of reducing the disease burden. In some areas however, a large proportion of the dog population is not accessible for parenteral vaccination because animals are too aggressive or free-roaming (owned and ownerless) and can therefore not be restrained. As a consequence, the overall vaccination coverage of the dog population in such areas is not sufficient to interrupt the transmission cycle and dog rabies persists. Oral vaccination programs by distributing vaccine baits have been successful in eradicating fox-mediated rabies from large areas in North America and Europe. Based on these positive results, the feasibility of oral vaccination of dogs against rabies (OVD) has been studied intensively in many different settings under supervision of WHO. Up to now, the outcome was not always successful, as effective OVD needs to fulfill all three pre-conditions; (1) a safe and efficacious vaccine, (2) a bait well accepted by the target population, and (3) a bait distribution system that maximizes bait availability to the target (sub)population, meanwhile minimizing uptake by non-target species. Only when all three conditions are met, OVD can increase the vaccination coverage obtained by mass dog parenteral vaccination, significantly. Here, we show two examples where OVD has been successfully incorporated as an additional tool in existing parenteral mass vaccination campaigns. Consequently, the obtained vaccination coverage by combining parenteral and oral vaccination was well over 70 % of the target population.

Methods

Three completely different areas were selected; an urban neighborhood in the metropolis Istanbul, another small city in Turkey and a coastal fishermen village in the Philippines. It was decided using a bait delivery system that maximizes bait availability to the free-roaming dogs inaccessible for parenteral vaccination (the target population), while minimizing the possibility of contact with the vaccine virus and/or — bait by non-target species, including humans. A so-called hand-out-model was developed, going from house-to-house and offering an oral bait to every dog encountered that is not accessible for parenteral vaccination. Baits not accepted by the dogs and discarded vaccine blisters were re-collected by the vaccinators. In such a way, the distribution system developed limits the risk of unintentional human contact with the vaccine virus and potential bait depletion by non-target species. The area was subdivided in sections and a small vaccination team was responsible for every section. Prior to the vaccination campaigns a house-to-house survey was conducted to determine the owned dog population size and to gather additional information on vaccination status and level of supervision (restricted or [partially] free-roaming).

Results

It became clear that the need for oral vaccination as a supplementary method to parenteral vaccination differed greatly between the study areas (Table 1). In urban settings of Istanbul (Turkey) most dogs could be vaccinated by the parenteral route (58 %) and 20 % of the dog population was reached by offering the animals a vaccine bait. However, in Mindoro (Philippines) none of the dogs had previously been vaccinated against rabies and only 17 dogs were accessible for parenteral vaccination; 9 % of total juvenile and adult dog population. Here, oral vaccination was essential in reaching acceptable levels of vaccination coverage. In both areas, approximately 20 % of the dogs could not be vaccinated because these free-roaming animals were not relocated during the campaign. Offering dogs a vaccine bait when not accessible for parenteral vaccination clearly showed that oral vaccination is especially useful for free-roaming and/or ownerless dogs (Table 2). Although it must be pointed out that in Kusadasi, Turkey, still 43 % and 26 % of the unrestricted and ownerless dogs, respectively, could be handled and vaccinated by the parenteral route.

Tables 1

Vaccination coverage of the dog population in two areas pre-, during and post-vaccination house-to-house campaign, incl. oral vaccination.

Area	Pre-campaign	During campaign		Post-campaign
		parenteral	oral (bait)	
Istanbul, Turkey	16 %	42 %	20 %	78 %
Mindoro, Philippines	0 %	9 %	67 %	76 %

Tables 2

The proportion of dogs vaccinated by the parenteral or oral (bait) route during a house-to-house vaccination campaign in Kusadasi in Turkey grouped according to confinement - and ownership status. Parenteral vaccination was always considered the first option.



Figures



Figure 1: Target population of oral rabies vaccination: free roaming dogs



Conclusions

Parenteral vaccination of dogs remains the cornerstone of dog rabies control. However, especially in areas with a high number of free-roaming dogs, vaccination coverage is often not sufficient to interrupt the chain of infection. It was shown that by integration of oral vaccination of dogs using the hand-out model in mass dog vaccination campaigns, the overall vaccination coverage can be significantly increased in such areas. The risk of unintended human contacts with the vaccine bait is negligible due to the selected bait distribution method, the hand-out model. Only under certain special circumstances vaccine baits can be placed at selected sites to target for example true feral dogs foraging at a dumping site. The results demonstrate that in certain areas a combined strategy of parenteral mass vaccination and oral vaccination of free roaming dogs will be able to shift the paradigm from expensive, annual rabies control programs, to a sustainable and in the end more cost-effective solution to eradicate dog-transmitted rabies.