# CANINE RABIES

A. I. Wandeler [1]

## 1 CANINE RABIES.

Rabies has a widespread occurrence in Africa, the Americas, Asia, and Europe. One can distinguish between areas in which dogs are the predominant recognized hosts and areas where rabies is maintained by wild animals. In those latter situations only 0.1-5% of the rabies cases reported annually are in dogs. In large parts of Asia, Africa and Latin America, rabies in dogs is much more common, making up 95% or more of all diagnosed rabies cases. Rabid dogs are also responsible for the vast majority of human cases. Most of them occur in developing countries, where in some places the recorded number may exceed 0.5 per 100,000 inhabitants per year. The number of people receiving post-exposure treatment after dog bites is between 10 and more than a 100 times higher than the number of recorded fatalities. Dog keeping practices, high rates of exposure and a number of cultural factors related to health systems lead to a high human rabies mortality rate. Even though dog rabies is often termed "urban rabies", it is clearly a rural problem in many developing countries.

In industrialized countries of North America and Europe, where the epizootic is maintained and spread by wild carnivores, three factors may account for the low incidence of rabies in dogs: most dogs are restricted in their movements; they are kept indoors or in enclosures and leashed when outside; dog vaccination is strong-ly recommended or even compulsory. Human rabies is rare due to low rates of exposure, high standards of health education, and relatively easy access to post-exposure treatment with potent vaccines.

Dogs are kept and tolerated at very high numbers in most human societies. Dog population densities may reach several thousand per km2; this is considerably more than any wild carnivore population ever achieves. Their abundance is not explained by their limited economic usefulness. The tolerance granted to them must find explanation in processes of socialization and psychology. Cultural conventions determine the level of supervision of their social interactions and access to resources (food, water, shelter, mates), which is partially a function of the density and structure of human settlements. It is assumed that high density dog populations permit the occurrence of enzootic canine rabies, but this is not very well documented. We suspect that the disease in dogs may not always exist independently from wildlife rabies. There is however, no doubt that rabid dogs are the major source of human infection.

For more details see Beran (1991), and Wandeler et al. (1993).

## 2 DOG POPULATION MANAGEMENT.

Rabies has a high incidence in dogs in areas where dog populations reach high densities and where the animals are poorly supervised. Attempts to reduce dog numbers and to educate owners toward responsible ownership should therefore be attempted. For this purpose the WHO/WSPA "Guidelines for Dog Population Management" should be consulted. Recommended control measures include movement restrictions, reproduction control, habitat control, and removal of straying dogs. The control of movements is intended to limit social contact and access to resources (both leading to disease transmission and uncontrolled reproduction). Reproduction control may be achieved through mating restrictions, surgical sterilization, and drugs (injectable, oral). Habitat control is meant to reduce the availability of resources (litter, waste, shelter). These approaches to population management are dependent on the promotion of responsible dog ownership; their implementation may often be too costly for achieving perceivable effects on a dog population. The removal of straying dogs usually has only

[1] Rabies Unit, Animal Diseases Research Institute, Agriculture Canada, Nepean, Ontario, Canada

insignificant impacts on population densities and is therefore not an productive method of population control, but it may serve law enforcement and is an aid to education in responsible ownership.

## 3 DOG VACCINATION IN AREAS WITH WILDLIFE RABIES.

In European and North American nations with predominant wildlife rabies dog vaccination is recommended or compulsory. Owners have to register (or license) dogs. Registration can be made dependent on the production of a certificate that the animal has been vaccinated against rabies when over 3 months old and has been revaccinated at periods of not more than 2 (or 1) years. Vaccinations should be done by parenteral inoculation of a product recognised by the National Authorities, usually an inactivated vaccine conferring two years of immunity after one injection.

## 4 RABIES CONTROL IN AREAS WITH CANINE RABIES.

Rabies control in areas with canine rabies is usually not a simple application of regulations on dog ownership. Their enforcement is impeded by a number of ecological and cultural constraints. But well planned and executed vaccination campaigns may reduce rabies incidence in dogs drastically and may even eliminate the disease in areas where it is not maintained by wildlife. Taking the cost and benefits of a campaign into consideration, we suggest that disease elimination should be the goal rather than a temporary reduction of the incidence rate. The most economical way to achieve this goal is by mass vaccination. Comprehensive national, rather than temporary, local plans are imperative. These plans have to identify a goal, and they have to consider national structures and resources. Effective intersectorial cooperation is necessary. Useful guidelines for programme management are :

- WHO, 1983: Guidelines for Dog Rabies Control
- WHO/FAO, 1990: Guiding Principles for Planning, Organization and Management of Veterinary Public Health Programmes

Both documents give detailed guidance on the planning and management of control programmes, on legislation, and on techniques in local programme execution.

For planning a comprehensive control programme it is necessary to consider a number of dog population parameters (size, turnover, accessibility). A vaccination coverage of about 75% of the total population should be attempted. This goal should be achieved in a particular area (of limited size) within a relatively short time period (a few weeks). A number of different approaches can be taken, e.g. temporary 'neighbourhood clinics', door-to-door vaccination. Pilot projects may help in assessing: 1) dog accessibility, 2) ways of cooperating with local residents and 3) avenues to provide information and education. Plans for large scale operations, vaccination strategies and logistic aspects can then be adjusted according to findings in the pilot phase. An effective maintenance programme must be part of the plan. Operational research for monitoring campaign efficiency is strongly recommended.

## 5 VACCINES.

### 5.1 Vaccines for oral use :

At present there are no vaccines available for oral immunization of dogs. Such vaccines are under development. They must meet higher safety standards than the presently used oral wildlife vaccines.

### 5.2 Vaccines for parenteral use :

Inactivated nerve tissue vaccines may be prepared from brains of lambs or suckling mice inoculated new-born i.c. with fixed viruses. They may be adjuvanted. These vaccines do not always have an efficacy comparable to the efficacy of inactivated tissue culture vaccines.

Whenever possible modern inactivated tissue culture vaccines should be used. They combine safety with high immunogenicity. Cell lines and primary cell cultures are used as substrates for a number of

virus strains. Several manufacturers include a variety of different antigens (distemper, adenovirus, leptospirosis, parainfluenza, parvovirus) in combined vaccines. No indication of competitive inhibition have been noted, but every new product should be investigated for its overall immunogenic potency.

The use of modified live (attenuated) vaccines is no longer recommended for dog immunization, except for special situations (e.g. national campaigns under economic constraints). Live recombinant vaccines and other products of genetic engineering will soon become available.

It is recommended that vaccines be completely innocuous, even for very young animals, and that they confer immunity for one (preferably two) years after one injection in all dogs above an age of three months.

There are no treatment schedules or vaccines licensed for post-exposure treatment of dogs.

For more details see Bunn (1988, 1991) and Precausta and Soulebot (1991).

## 6 QUESTIONS, RESEARCH NEEDS, OPERATIONAL RESEARCH.

Rabies in dogs is a significant threat to human health. An estimated 30,000 people are dying from dog transmitted rabies per year. The widespread occurrence of human rabies is not only due to the frequency of exposures, but also to the failure of applying proper treatment after bites from rabid animal. More inquiries into health systems and the ethnology and sociology of preventing and curing dog transmitted diseases are clearly indicated.

Dog rabies epizootiology is not well understood and it is rather unfortunate that more thorough studies have never been done. It is sometimes questionable if canine rabies is really independent from a wildlife reservoir. Structural constraints and a shortage of resources may often preclude a suitable epizootiological surveillance. On the other hand, the easy access to dog populations should allow collection of valuable data, e.g. detailed case histories (possible source of infection, other animals/humans exposed, etc.).

A number of dog populations in different parts of the world and in different ecological and cultural settings have been studied in recent years (Wandeler et al., 1993). We feel that dog population biology is reasonably well explored. Although, one has to remember that tolerance, supervision, availability (accessibility) of resources, and other aspects of the "habitat carrying capacity" are human cultural traits that vary dramatically from area to area. Attributes of culture not only determine dog population characteristics, but also their accessibility for control operations. Questionnaire surveys produce information on dog:human ratios, dog keeping practices, reproduction, morbidity and mortality, etc. However, such data relate only to the owned segment of a dog population. If there is a suspicion that there are ownerless dogs, one should resort to an experimental approach as used by wildlife biologists (for a description of techniques see e.g. Caughley, 1977, or Davis and Winstead, 1980). Modified mark-recapture techniques can be implemented without too much difficulties during mass vaccination campaigns. Such "operational research" conducted in conjunction with pilot projects may provide a large amount of useful data.

Pilot projects in general may help in assessing 1) dog accessibility, 2) ways of cooperating with local residents, and 3) avenues to provide information and education. Plans for large scale operations, vaccination strategies and logistic aspects can then be adjusted according to findings in the pilot phase. We also suggest that in future programmes, some operational research be conducted in order to monitor campaign efficiency.

## BIBLIOGRAPHY.

Beran, G.W. (1991) Urban Rabies. In G.M. Baer (Ed.): The Natural History of Rabies, 2nd Edition. CRC Press, Boca Raton, 427-443.

Bunn, T.O. (1988) Vaccines and Vaccination of Domestic Animals. In J.B. Campbell and K.M. Charlton (Eds.): Rabies. Kluwer Academic Publishers, Boston/ Dordrecht/london, 323-333.

Bunn, T.O. (1991) Canine and Feline Vaccines, Past and Present. In Baer G.M. (Ed.): The Natural History of Rabies, 2nd Edition. CRC Press, Boca Raton, 415-425.

Caughley, G. (1977) Analysis of Vertebrate Populations. John Wiley, Chichester.

Davis, E.E. and Winstead, R.I. (1980) Estimating the Numbers of Wildlife Populations. In S.D. Schemnitz (Ed.): Wildlife Management Technique Manual. The Wildlife Society, Washington, D.C., 221-245.

Precausta, P. and Soulebot, P.-J. (1991) Vaccines For Domestic Animals. In Baer G.M. (Ed.): The Natural History of Rabies, 2nd Edition. CRC Press, Boca Raton, 445-459.

Wandeler, A.I., Matter, H.C., Kappeler, A. and Budde, A. (1993) The Ecology of Dogs and Canine Rabies: A Selective Review. Revue Scientifique et Technique de L'office Internationale des Epizooties 12: 51-71.

WHO/WSPA (1990) Guidelines for Dog Population Management. World Health Organization, Geneva. (WHO/ZOON/90.165)

WHO (1983) Guidelines for Dog Rabies Control. World Health Organization, Geneva. (VPH/83.43)

WHO/FAO (1990) Guiding Principles for Planning, Organization and Management of Veterinary Public Health Programmes. World Health Organization, Geneva. (ISS/WHO/FAO-CC/IZSTE/90.11)