Rabies control

Current best practices in domestic and wild animals
Epidemiology of Rabies

TERRESTRIAL CYCLE

Lyssavirus
Genotype 1

AERIAL CYCLE

Lyssavirus
Genotypes 5 (EBL1) and 6 (EBL2)

Insectivorous bats
What is observed in terrestrial rabies

- Very close host – virus co-adaptation:
  - Virus is very specific of its natural host
  - This host is very sensible to its homologous virus
  - The host shows a 100% salivary excretion when infected by its homologous strain
  - Salivary excretion occurs before any clinical sign
How can we control rabies?

- Action on the vector
  - Depopulation
  - Reduce availability of food
  - Contraception

- Action on the cycle of the disease:
  1. Vaccination
     - Protects people
     - Protects domestic animals and man
     - Cuts the transmission cycle, eradication of the disease
Prerequisites for rabies control

- Knowledge of the disease situation = SURVEILLANCE
  - Descriptive epidemiology (incidence, localisation, infected species)
  - Virus typing
- Knowledge of the local biology of the host
- Legislative measures
  - Rabies is a notifiable disease
  - Inter sectorial cooperation

Sanitary measures

Medical measures
Prerequisites: rabies situation

- Nothing can be efficiently done to control rabies without a precise knowledge of rabies situation in the country.
- Surveillance of the disease needs
  - Laboratory diagnosis structures
  - A specimen collection network to bring suspects animals to laboratories
  - Perform epidemiological diagnosis ➔ host identification
  - Have a virus typing capacity or access to a reference laboratory
  - Centralisation of epidemiological data and exchange of information with neighbouring countries
Prerequisites: biology of the host

- Population structure (age, sex)
- Behavioural data (size of the territory)
- In case of dog population
  - Presence of a stray population and proportion of it
  - Relation with humans
- Evolution of the density
Prerequisites for rabies control

Sanitary measures
- Movement restriction
- Depopulation measures
- Reproduction control

Medical measures
Sanitary measures: host depopulation

- For both wildlife and dog rabies, the idea is to reach a density of host species under the density needed to maintain the disease.
Efficacy of fox depopulation in rabies control (1)

Aubert, 1992

- In Belgium between 1966 and 1986
  - Intense gassing of fox dens with HCN → transient reductions of the disease (Marchal et al., 1984).
  - Debated by Collet (1978): gassing was unable to prevent re-invasions
Efficacy of fox depopulation in rabies control (2)

- In France
  - In Yonne, high culling pressure without effect in entry of rabies in the département. The 1985 decrease ➔ increase of rabies in 1986
  - In Bas Rhin, 3 years of culling have a little effect the year after
Efficacy of fox depopulation in rabies control (3)

- In France
  - In Seine et Marne, high culling pressure stops rabies in 82-83, but rabies returns in 1984 despite the maintained high culling pressure
  - In Nièvre, similar evolution
Efficacy of fox depopulation in rabies control

- When bounties were attributed, rabies decreased (74 times) or increased (79 times) during the following year. The statistical analysis confirms the lack of significant influence of bounties on the future of the epizootics ($\chi^2 = 1.25$) or at least the lack of predictive value of bounty statistics.

- Consideration of more reliable data (rabies cases in domestic cats only, because they are seldom vaccinated), did not change the conclusion (Aubert, 1988).
Dog population control methods

- Different methods may be used
  - Depopulation
  - Movement restriction of owned dogs
  - Habitat control
  - Reproduction control
Needs to cull regularly up to 80% of the population

- Very difficult to reach and not accepted by people
- Not considered an effective direct control measure
- Some indirect benefits may exist however when eliminating locally dogs
  - that have not been vaccinated during mass vaccination campaigns
  - that accumulate around food resources (markets, abattoirs, public dumps)

The removal rates are generally <15% of the dog population and it is compensated by an increased survival rate
Habitat control

- The relation between (food availability + existence of refuge area) and reproduction success (litter size) is important in maintaining the population.
  - Illustrated by the urban fox.
  - Reduction of food availability will reduce the risk of seeing poorly supervised or stray dog population install in villages, market places or around slaughterhouses.
Reproduction control

- Control of environment
- Animal birth control measures
- Immunocontraception projects
The idea is to maintain some animals protected and unable to reproduce as a locking group that prevents “foreign” dogs to enter.

Method used in Asia since the 1960’s coupled with vaccination to control urban street male and female dogs, it has been cited again in the guidelines for dog population management (WHO/WSPA, 1990).
ABC operations in India
Immunocontraception

- The idea is to develop a vaccine specific of dogs to block reproduction
- The interest is that behaviour should not change and the animals will occupy and protect their territories against the entry of new animals
- Long term research programme
Prerequisites for rabies control

Sanitary measures

Medical measures
- Vaccination of susceptible domestic animals
- Vaccination of the host parenteral / oral
  - Vaccination strategy
  - Vaccination policy
  - Control the efficiency of measures
Parenteral vaccination of domestic animals

- In wildlife rabies areas:
  - It will protect the animal and people that may be contaminated when the domestic animal is infected
  - No influence on the disease cycle itself
  - Parenteral vaccination of the host although possible is not practically feasible

- In dog rabies areas:
  - It will protect the animal and people that may be contaminated when the domestic animal is infected
  - Influence on the disease cycle itself
In case of dog rabies

“To ensure effective coverage, vaccination programmes should consider the local ecology of the dog population, involve coordination of related sectors and incorporate culturally appropriate education efforts” (1st expert consultation on rabies)

- Intersectorial cooperation
- Epidemiological surveillance
- Mass vaccination campaigns
- Dog population study
- Dog population control
Dog rabies control and elimination: vaccination

- Different trials conducted in Africa, Latin America and Asia have shown a vaccination coverage of 60 to 75% of the dog population.
- The 70% value for the vaccination coverage before observing a rabies decrease should be adapted to local conditions.
- Increasing the vaccination coverage:
  - First use parenteral inactivated vaccines, oral vaccine is only the way to vaccinate dogs that cannot be handled by their owner.
  - Vaccination strategy:
    - Expansion method begins in a limited area that is slowly expended to cover the entire country.
    - Global method on a large area or on the entire country immediately.
    - Hot spots in geographically distinct areas with a high incidence of rabies that are then expended.
Choice of the vaccine

- Cell culture adjuvanted inactivated vaccines should be preferred although lamb or kid brain inactivated vaccines are acceptable.
- The vaccine should titrate at least 1.0 IU/dose (NIH or pharmacopoeia potency test).
- The vaccine should induce a protection of at least 1 year.
- The vaccine should protect puppies.
General preparation

- Educational campaigns
- Intersectorial cooperation
- Community participation
- Local commitment in planning and execution
- Availability of recognised quality vaccine
- Media support
- Effective general coordination by health services (WHO, 2005)

- It should be clearly established that rabies control by vaccination should be uninterrupted till the eradication of the disease in the area
Practical organisation

- Annual campaigns, more frequent when turnover of the population is high ➔ it is necessary to know the dog population
- All dogs and cats presented for vaccination should be vaccinated, whatever their age or sanitary status. Due to the high birth rate of many populations, the puppies are important to vaccinate.
Practical organisation (2)

- Public information on the campaign
- Identification of vaccinated dogs is recommended. The use of temporary coloured collars
  - motivate dog owners
  - allows to perform estimation of the global dog population by "capture-marking-recapture"
- 3 approaches to perform vaccination:
  - House to house visits
  - Fixed vaccination points in well-recognised sites in the community
  - Mobile vaccination points.
- People will not come if the vaccination point is distant from more than 500m or 10 minutes walk
Monitoring the effect of mass vaccination campaigns

- **During campaigns**
  - Monitoring of vaccine titre before and during campaigns gives an estimation of the preservation of vaccines in the field

- **After campaigns**
  - Serological surveillance of animals 1 month post vaccination

- **The ultimate index is the decrease of human and animal rabies cases.**
  - Once again, it underlines the fundamental importance of surveillance of the disease
Documents

- Strategies for the control and elimination of rabies in Asia WHO/CSR/EPH/2002.8
- WHO expert consultation on rabies, 1st report, 2005, WHO technical reports series 931
Thank you for your attention