1 INTRODUCTION.

Rabies is endemic in Madagascar, with the dog reported as the sole reservoir of the virus (Coulanges, 1982). Since the first cases reported in dogs and humans more than one hundred years ago, rabies is an acute public health threat, with a continued rise in the number of cases throughout the 1980s (Morvan, 1992).

Madagascar has a surface area of 587000 km² and is the fourth largest island in the world with a population of 14.5 millions inhabitants of whom 44.1% are under 15 years old and 22% are living in urban areas. (source Ministry of the Population, 1995). A 2.8% population growth may result in a doubling within 25 years.

The Direction of transmissible disease prevention form the Ministry of Health created in 1994 an epidemiological unit, the Epidemiological Surveillance Service, in charge of collecting data on transmissible diseases and sending results of epidemiological investigations and surveillance via a journal published four times a year, the Bulletin d'Information en Epidémiologie en Sante publique. A result of this new network is an important increase of reported human rabies (Rakotomalala W et al., 1998).

Only few data on the epidemiology of rabies are available. The Pasteur Institute is in charge of the National Laboratory for Rabies diagnosis, and provides human vaccine for the different rabies centres. It is collecting data on human treatments and provides all information to the Ministries of Health and of Agriculture for actions. Estimates of the dog population size are not available.

2 LABORATORY RABIES DIAGNOSIS.

Table 1 : Distribution of specimens tested for rabies by species for the period 1994-1998.

<table>
<thead>
<tr>
<th>Species</th>
<th>Tested No.</th>
<th>Positive No (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Humans</td>
<td>6</td>
<td>4 (66.7)</td>
</tr>
<tr>
<td>Animals</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dogs</td>
<td>347</td>
<td>240 (69.2)</td>
</tr>
<tr>
<td>Cats</td>
<td>33</td>
<td>9 (27.3)</td>
</tr>
<tr>
<td>Lemur</td>
<td>26</td>
<td>1 (3.8)</td>
</tr>
<tr>
<td>Ruminants</td>
<td>13</td>
<td>9 (69.2)</td>
</tr>
<tr>
<td>Rats</td>
<td>6</td>
<td>4 (66.7)</td>
</tr>
<tr>
<td>other</td>
<td>2</td>
<td>1 (50.0)</td>
</tr>
<tr>
<td>Total</td>
<td>427</td>
<td>264 (61.5)</td>
</tr>
</tbody>
</table>

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1 Centre National de Référence pour la Rage, Institut Pasteur - BP 1274 - Antananarivo 101 - MADAGASCAR
2 Service de Surveillance Epidémiologique, Direction de la Lutte contre les Maladies Transmissibles - BP 460 - Antananarivo 101- MADAGASCAR
Rabies diagnosis includes:

- direct immunofluorescence assay (IFA) on brain smear
- confirmation test by intra-cerebral inoculation into suckling mice and test by IFA from day 4 post-inoculation without any clinical symptoms, with an extended observation up to day 20.

During the 1994-1998 period, only 427 specimens were tested. The number of specimens is low and was decreasing: 78 in 1994, 67 in 1995, 65 in 1996. An effort was made in 1997 to encourage veterinarians to ask for rabies diagnosis in suspicious animals (free of charge): 92 specimens were received in 1997 and 126 in 1998. Eighty four per cent of the specimens (361) originated from the capital Antananarivo, (35) 8% from the Antananarivo province and only 33 (8%) from the five other regions. Among these, 61.5% specimens were positive, showing the presence of rabies in all provinces (Figure 1).

Figure 1: Spatial distribution of confirmed cases of Rabies in animals (1994-1998).

3 Human Rabies.

For the period 1899-1998, 166 cases of human rabies were reported in Madagascar and among these, 49 cases (29.5%) were reported for the last three years (1996-1998). Figure 2 shows the distribution of reported cases in 1994-1998 (3 cases in 1994 and in 1995, 13 cases in 1996 and 1997, and 23 cases in 1998). Five cases were confirmed by the laboratory. Twenty five cases (51.0 %) were reported in the Antananarivo province and 11 cases (22.4%) in the Toamasina province. Forty five per cent of the Malagasy population is living in these two provinces. In the Fianarantsoa province, in 1994-1998, 5 human cases of rabies were reported and only one rabid animal was diagnosed.
4 TREATMENTS.

Two kinds of vaccine are used for treatments:

- A suckling mouse brain (SMB) vaccine (from Pasteur Institute Alger) with a classical schedule: eight injections on days 0 to 7 by sub-cutaneous route and boosters by intra-dermal route on days 11, 15, 30 and 90, free of charge,
- A cell culture vaccine (VeroRab™) with scheme 2-1-1 by IM route on day 0 (2 doses), day 7 and day 21, free for children under 2 years-old, and possibly on charge for other patients

Only the SMB vaccine is distributed to the secondary rabies centres.

An important public health reform occurred in 1997 with the establishment of 110 sanitary districts throughout the country. In order to improve access to rabies treatments for the population, the creation of a rabies centre in each district was effective in 1998. The theoretical number of centres was increasing from 54 to 110. In fact, 59 centres were active in 1998.

In 1998, a total of 5165 consultations for rabies exposure were recorded, or an increase of 6.0% from 1997. The main cause of exposure was the dog (93% of the consultations, followed by the cat (4%) (Figure 3). Of 5165 patients, with a male/female sex ratio of 1.4/1.0 and 38% of children under 15, 82% received treatment. Patients bitten by stray dogs represented 70% of the treatments. 83% of the treatments were conducted within 5 days post exposure. In 7% of the cases, the delay exceeded a week.

If bites by wild lemurs are not reported, domestic lemurs used as pets represented the third source of exposure. In 1993, the first case of rabies in a lemur was reported. The animal, a Lemur catta, belonged to a tourist resort and was in contact with many dogs. This Lemur species is particularly curious and sometimes aggressive. People must be aware of the risk of rabies exposure when bitten by these animals.

In Antananarivo city, a 17% increase of consultations (4150) and 20.0% increase of treatments (2380) were recorded in 1998 vs 1997. One third of the owned dogs were reported to be vaccinated (225/666). In 2.7% of the cases, equine rabies immune serum was also given. Local reactions following the vaccine injections vaccine were reported in 0.7% of the treated patients.
In the other parts of the country, the number of notified treatments in humans from other centres is apparently decreasing. In fact, information about treatments were received from only 19 centres in 1998 vs 35 in 1997.

A failure of treatment was reported in 1998 in a 61 years-old woman bitten on her left foot by a dog which 3 days later died of rabies confirmed in the laboratory. She consulted on day 1 with a stitched wound on her right foot and was treated with the SMB vaccine. On day 32 post exposure, an ascending paralysis of her legs appeared and she had respiratory problems. She died on day 40. Both the canine and the human strains of rabies virus were identical by partial genetic analysis of the sequences (H. Bourhy, Pasteur Institute Paris, personal communication). Two other persons reported bitten the same day by this dog were treated from day 4 post-exposure.

5 Rabies control.

5.1 Animal immunisation.

Using a common human dog ratio of 10:1 as reported in Africa, an estimate of 1.4 million dogs are present in Madagascar. For animal immunisation, several types of animal vaccines are used: a local Flury vaccine (Lyorab™) and very few imported vaccines. Annually 3000 to 4000 doses of rabies vaccine are produced in Madagascar (JJ Rajaonarison, personal communication). The number of immunised animals each year is unknown.

Among 12 dogs reported as immunised in 1998 and tested for rabies, 7 were positive: 2 were immunised in less than 1 year and 1 in less than 2 years. For the others, exact data were not recorded. Failure of immunisation by Flury type vaccine was previously recorded but further investigations are needed (Ribot, 1982).

5.2 Rabies control.

If the real economic impact of rabies can be evaluated (vaccine cost, working-time loss…) in human public health, data are inadequate to evaluate the real impact in agriculture. An effort initiated by the Ministry of Health and the Pasteur Institute was made to reinforce the role of public and private veterinarians in rabies for a better application of existing rabies regulations.

The Ministry of Breeding Stock is theoretically in charge of the epidemiological surveillance of rabies. The deterioration in the infrastructures for disease control is evident for many other animal diseases as bovine tuberculosis, classical swine fever, African swine fever…This situation coincided with a period of restructure of the veterinarian services resulting in the division of responsibilities. Rabies does have the same economical impact despite the loss of rabid animals in comparison with the other plagues.
Despite numerous interventions, and the important increase of human cases these last years the Ministry of breeding-stock via the Direction of the Veterinarian Services are not planning to coordinate action to contain the actual explosion of rabies in large cities and in the countryside.

6 Conclusion.

The data presented on the epidemiology of rabies in Madagascar have shown the emergency of an national action on rabies. An integrated rabies control program at the national level must be carried out in relationship with a continuous information of the population and health workers about the risks of exposure. Likewise, the presented data showed some areas where specific actions must be conducted as a priority: the Antananarivo urban area, and two regions on the West and the East of the capital.

References.


