

## RABIES IN DOMESTIC ANIMALS IN TANZANIA: A DIAGNOSTIC CHALLENGE TO VETERINARIANS

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### ABSTRACT

*Although the vaccine against rabies was first used in humans in 1884, todate rabies is still a major zoonosis in Tanzania. Between 1995 and 1999, 63 rabies-suspected cases were presented at the Sokoine University of Agriculture Veterinary Clinic and Department of Veterinary Pathology for diagnosis. Of the 63 cases, 57 were dogs, two bovines, two goats and two cats. Two dogs and one cat were referrals from Dar es Salaam region, whereas from Morogoro rural area three dogs and one goat were presented as rabies suspects. In Morogoro municipality, 56 animals were suspected of having rabies out of which 52 were dogs, two were cattle, one goat and one cat. Rabies was confirmed in 38 dogs, one cattle, one goat and one cat using Fluorescence Antibody technique (FAT). Of the confirmed rabies positive cases, one dog was showing signs of drooling of the saliva for over one month, with no any other clinical sign. In addition, one of the dogs that were referred from Dar es Salaam region, 200 kilometers away, developed signs of general weakness followed by blindness, accompanied by convulsions, chorea and paralysis with no sign of aggression. The dog died two weeks later and was confirmed positive for rabies. In the study, one dogs contracted rabies within one year of vaccination against rabies. Weak FAT positive and negative results have also been encountered in dogs showing typical signs of rabies characterised by sudden change of behaviour, attacking animate and inanimate objects, salivation and paralysis. The study has shown that rabies is prevalent in domestic animals in Morogoro and neighbouring areas. The presence of cases of rabies in vaccinated dogs, and in dogs showing no signs of aggressiveness causes great diagnostic challenges to the veterinarians. Moreover, FAT negative results in animals showing typical signs of rabies require serious attention and should be considered as rabies cases. Therefore, there is a need of changing diagnostic approach when dealing with rabies suspect cases. Further studies are required in order to establish the existing rabies strains in the country with the aim of devising appropriate control measures against the disease.*

Key words: rabies, atypical rabies, aggressiveness, paralysis, salivation

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### INTRODUCTION

Rabies is an ancient disease affecting a wide range of animal species world-wide. Although the vaccine against rabies was developed in early 1880's, todate rabies is still a major zoonosis in Tanzania and elsewhere.(Turner, 1977; Bogel and Meslin, 1990; TVA annual zonal Meeting reports, 1992). Over 99.9% of the case mortalities due to rabies occur in the developing countries whereby the domestic dogs are the principle transmitter of rabies to human beings (Kitala *et al.* 1993). In the developed countries, rabies is confined to

wildlife reservoirs, but the cost involved in the control of the disease is immense (Bogel and Meslin, 1990).

Rabies was first confirmed in Tanzania in 1936 (Magembe, 1985; Rweyemamu *et al.*, 1973; Machuva, 1988). Serious rabies epidemics occurred in the 1970's and 1980's, coinciding with reports of the disease in Kenya. Presently, the whole country is affected by rabies. Although the current situation of rabies is alarming, limited studies have been conducted to determine the prevalence of rabies in both human beings and animals (Rweyemamu *et al.*, 1973)

Rabies belongs to the genus lyssavirus with 7 recognised genotypes, all capable of causing encephalitis in mammalian species. Genotype 1 is the common cause of rabies in mammalian hosts and is known as classical or true rabies virus. The rabies related viruses include the Lagos bat virus (genotype 2), Mokola (genotype 3) and Duvenhage (genotype 4). The European bat lyssavirus (EBL) has two genotypes; genotypes 5 (EBL1) and genotype 6 (EBL2) (Bourhy *et al.*, 1993). Recently, a new lyssavirus strain designated Genotype7 or Australian bat lyssavirus (ABL) has been reported (Hooper *et al.*, 1997). All rabies isolates identified from the reported cases in Tanzania belong to the classical rabies virus or genotype 1 (Loretu, 1985; 1988). There are no reports of rabies related viruses in Tanzania.

Rabies related viruses have been associated with rabies in various animal species. Atypical cases of rabies have been reported in vaccinated cats naturally infected with Lagos bat virus (Swanepoel *et al.*, 1993). In Zimbabwe, Mokola virus has been isolated from rabid dogs previously vaccinated against rabies (Foggin, 1988). Mokola virus has also caused rabies in a laboratory personnel who had received pre-exposure vaccination against rabies using human anti-rabies vaccines (Brown and Crick, 1977). Whereas lack of cross protection between Mokola virus and other rabies virus genotypes has been demonstrated in dogs (Brown and Crick, 1970; Rupprecht *et al.*, 1995), other studies have reported poor protection using vaccines against rabies in dogs infected with rabies-related viruses (Shope *et al.*, 1970; Tignor and Smith, 1972; Fekadu *et al.*, 1988). Cases of dogs dying within one year of vaccination against rabies have also been observed in Nigeria. The dogs were infected with four distinct viral subtypes uncommon in the vaccines used in the area (Aghomo and Rupprecht, 1990).

Diagnosis of rabies is based on the clinical signs, pathological examination and mouse inoculation for confirmation (Swango, 1989). FAT on brain smears of rabies suspected cases is the main diagnostic technique for confirmation of rabies in most laboratories (Center for Disease Control CDC, 2000). Although Negri bodies demonstration in histological sections is pathognomonic for rabies, its reliability is low as Negri bodies can be detected in only 50% of the cases (CDC, 2000). Weak FAT reactivity has also been demonstrated in brain smears from dogs infected by Genotype 2, 3 and 4 (Rupprecht *et al.*, 1995). Furthermore, Genotype 4 rabies virus has been associated with FAT negative results in a rabid dog found positive for Negri bodies (Rupprecht *et al.*, 1995)

The present study reports on cases of rabies encountered at the Sokoine University of Agriculture, Faculty of Veterinary Medicine Veterinary Clinic and the Department of Veterinary Pathology between 1995 and 1999. The main objective of this paper is to highlight the diagnostic challenges facing veterinarians and other animal health workers in dealing with rabies cases.

## MATERIALS AND METHODS

### Data Collection

The present study was based on the clinical records of rabies cases reported at SUA Veterinary Clinic and Department of Veterinary Pathology between 1995 and 1999. Data in the clinical records included species of animals, age, sex, history of the disease and the main presenting signs. Other information was the location from which the animal originated. The ages of the animals were recorded as below 3 months, 3 to 6 months and above 6 months. Where information on the age was not available it was recorded as unknown. The origin of the animals was recorded as Morogoro urban for those cases from Morogoro municipal area, Morogoro rural for cases from outside Morogoro municipality and Dar es Salaam for the three-referral cases.

Clinical history and biodata were also recorded from dead animals brought to the clinic or Veterinary Pathology Department for confirmation of rabies. Confirmation of the diagnosis was mainly based on the results from the fluorescence antibody technique (FAT) of the brain smears and histopathological examination for Negri bodies of FAT negative specimens.

## RESULTS

### Clinical Rabies

Basing on the records, five main categories of the clinical signs were identified, including change of behaviour and aggression, paralysis, salivation, other nervous signs and non-specific signs. Table 4 shows common clinical signs observed in rabies suspect cases in various domestic animals in the present study.

### Number Of Cases Surveyed

A total of 63 cases were reported at SUA clinic as rabies suspect cases of which 56 came from Morogoro urban area, four from Morogoro rural and three from Dar es Salaam, 200 kilometers away. Of these, 57 were dogs, two of which were referred from Dar es Salaam, three from Morogoro rural area and 52 from Morogoro urban. Other animals included two cattle, one goat and one cat from Morogoro urban, and one goat from Morogoro rural. The number of rabies suspected cases reported at the clinic between 1995 and 1999 were 3, 14, 17, 17 and 12, respectively. Of the reported cases, 26 (41%) were male, 19 (30%) females and 18 (29%) animals with no data on sex (Table 2). There were two animals of less than 3 months of age, 4 aging between 3 and 6 months old, 47 aged over 6 months old and 10 of undetermined ages (Table 3).

### Overall Prevalence of Rabies

Of the 63 reported cases of rabies suspected animals, 41 (65%) were confirmed positive for rabies. As shown in Table 3, rabies was confirmed in one dog of less than three months old and three dogs aged between 3 and 6 months old. Rabies was also confirmed in 30 dogs, one cow and one goat of over 6 months of age. The prevalence of rabies in dogs over 6 months of age was higher than in other age groups. A total of 5 out of 10 animals with no records on

age were rabies positive. Rabies was confirmed in 14 (22%) male and 15 (23%) female animals. Rabies was also confirmed in 12 (19%) animals with no data of their sex category.

### Rabies in Domestic Dogs

Of the 57 dogs reported as rabies suspect cases, 38 (67.%) were confirmed positive for rabies. Although 10 dogs had no records of their ages, higher prevalence of rabies was observed in dogs aged over 6 months old. The main presenting sign of rabies in dogs was change of behaviour. Other encountered signs included paralysis of the limbs, jaw and tongue and salivation (Table 4).

**Table 1: Annual number of rabies suspect cases in various domestic animals for the period 1995 to 1999**

YEAR	Number Examined	Rabies Positive	Canine	Feline	Bovine	Caprine
1995	3	3	3 (3)	0	0	0
1996	14	7	13 (7)	0	1(0)	0
1997	17	11	16 (10)	1(1)	0	0
1998	17	11	16 (11)	0	0	1(0)
1999	12	9	9 (7)	1 (0)	1 (1)	1 (1)
<b>TOTAL</b>	<b>63</b>	<b>41</b>	<b>57 (38)</b>	<b>2 (1)</b>	<b>2 (1)</b>	<b>2 (1)</b>

( )= Figures in parenthesis indicate rabies positive cases

**Table 2: Records of rabies suspect cases in relation to sex of the animals**

SPECIES	Number Examined (FAT Positive)			TOTAL
	Male	Female	Unknown	
CANINE	25 (14)	15 (13)	17 (11)	57 (38)
BOVINE	1 (0)	1 (1)	0	2 (1)
CAPRINE	0	2 (1)	0	2 (1)
FELINE	0	1 (0)	1 (1)	2 (1)
<b>TOTAL</b>	<b>26 (14)</b>	<b>19 (15)</b>	<b>18 (12)</b>	<b>63 (41)</b>

( )= Figures in parenthesis indicate rabies positive cases

**Table 3: Number of rabies suspect cases in various age groups of the animals**

SPECIES	AGE GROUPS				TOTAL
	<3Months	3-6Months	>6Months	Unknown	
CANINE	1 (1)	4 (3)	43 (30)	9 (4)	57 (38)
BOVINE	0	0	2 (1)	0	2 (1)
CAPRINE	0	0	2 (1)	0	2 (1)
FELINE	1 (0)	0	0	1 (1)	2 (1)
<b>TOTAL</b>	<b>2 (1)</b>	<b>4 (3)</b>	<b>47 (32)</b>	<b>10 (5)</b>	<b>63 (41)</b>

( )= Figures in parenthesis indicate rabies positive cases

**Table 4: Common clinical signs observed in rabies suspect cases in various domestic animals**

CLINICAL SIGN	FREQUENCY OF OCCURRENCE			
	Canine	Bovine	Caprine	Feline
<b>BEHAVIOURAL CHANGE</b>	<b>46 (34)</b>		<b>1 (1)</b>	<b>1 (1)</b>
Abnormal barking	2(2)			
Aimless wandering	6(4)			
Viciousness	27(20)			
Other abnormal behaviours	11(8)		1 (1)	1 (1)
<b>PARALYSIS:</b>	<b>31 (14)</b>		<b>2 (0)</b>	<b>2 (0)</b>
Paralysis of the limbs	17 (7)		1 (0)	1 (0)
Paralysis of the jaw	11 (5)		1 (0)	1 (0)
Paralysis of the tongue	3 (2)			
<b>SALIVATION</b>	<b>12 (7)</b>	<b>2 (1)</b>	<b>1 (1)</b>	
<b>OTHER NERVOUS SIGNS</b>	<b>4 (0)</b>			
Convulsion	1 (0)			1 (0)
Blindness	1 (0)			1 (0)
Chorea	1 (0)			
Dilated pupils	1 (0)			
<b>NON SPECIFIC SIGNS:</b>	<b>28 (13)</b>			
Anorexia	11 (5)	1 (1)		
Pyrexia	4 (3)			
Lethargy	3 (2)			
Dullness	3 (1)	1 (0)		
Arched back	1 (1)			
Lacrymation	1 (0)		1(1)	
Protrusion of the eye ball			1(1)	
Erect ears			1(1)	
Erect tail			1(1)	
Coughing	2 (1)			
Dyspnoea	1 (0)			
Diarrhoea	2 (1)			

( ) = Figures in parenthesis indicate rabies positive cases

**Table 6: Cases of rabies reported from various locations between 1995 and 1999**

LOCATION	REPORTED CASES				
	CANINE	BOVINE	CAPRINE	FELINE	TOTAL
Morogoro Urban	52 (34)	2 (1)	1 (0)	1 (1)	56 (36)
Morogoro rural	3 (2)	0	1 (1)	0	4 (3)
Dar es Salaam	2 (2)	0	0	1 (0)	3 (2)
<b>Total</b>	<b>57 (38)</b>	<b>2 (1)</b>	<b>2 (1)</b>	<b>2 (1)</b>	<b>63 (41)</b>

( ) = Figures in parenthesis indicate rabies positive cases

Of the reported cases from Morogoro urban, one dog had a history of salivation for over one month period without showing any other clinical disease. The dog was almost discharged when suddenly became recumbent and died two days later. FAT results were highly positive for rabies. Another dog was referred from Dar-es-Salaam, about 200km from Morogoro. The dog had a history of anorexia, laboured breathing, constipation, conjunctivitis and pyrexia of up to 40°C. Later on the animal developed chorea, blindness, lethargy and congestion of the conjunctival and vaginal mucosae. The animal became recumbent and died 18 days after the initial onset of the clinical signs. The animal was strongly FAT positive for rabies.

A four-year old dog, routinely vaccinated against rabies, was confirmed positive for rabies just one month after being overdue for an annual booster vaccination. Another dog was vaccinated against rabies 7 months previously but developed signs of rabies and was FAT positive for rabies. Negative results of FAT, Negri bodies and mouse inoculation were encountered in a dog with signs of aggressiveness to the owner, other people, animals or objects, paralytic and hypersalivating. In 1996, negative FAT results and Negri bodies were observed in a rabies suspect dog but the histopathology revealed non suppurative encephalitis, suggestive of rabies.

### **Rabies in other Animal Species**

Rabies was confirmed in one of two bovine cases showing signs of behavioural changes and salivation. One of the cases was reported in 1996 and the other one in 1999 which was FAT positive for rabies. From the history, both animals had nervous signs characterised by aggressiveness with hypersalivation. Both cases had a history of being bitten by rabid dogs.

Rabies was also reported in one goat from Morogoro rural in 1999. The goat had signs of change of behaviour characterised by attacking people, other animals and moving objects. Other signs observed in the goat were protrusion of the eyeball, erect ears and tail. Rabies was confirmed using FAT of the brain smear from the goat.

Again, in 1997, a cat with a history of attacking people and other animals was brought to SUA clinic. The cat had never been vaccinated against rabies and was said to have been bitten by a rabid suspect dog. The FAT test of the brain smears of the cat was positive for rabies.

## DISCUSSION

Rabies, the disease that appears in medical records since 300BC, is still threatening life of animals and human beings in Tanzania. The number of reported cases of rabies observed in the present retrospective study involve just a few cases that the concerned owners sought veterinary attention. There is a strong indication that most animals with rabies die or are killed without confirmation of the disease. It has been observed that over 90% of the cases of rabies were reported from areas around Morogoro municipal area. This suggests that higher number of unreported rabies cases might be existing in the rural areas where the population of dogs is high. The limited number of cases of rabies reported from the rural areas could be attributed to ignorance of some of the owners and the distance involved from the rural areas to SUA clinic.

Although some of the data on sex of the animals were not available, more male dogs were reported as rabies suspected cases than the females. The sexual behaviour of dogs whereby fighting is common during mating season could be the main reason for the higher number of rabies cases in male compared to female animals. In addition, there is a tendency of keeping male dogs in preference to female dogs by some dog owners. This could also be supported by the significantly higher number of rabies reported cases in dogs over 6 months of age. Rabies was also reported in two puppies of less than 3 months old. Routine vaccination against rabies is often recommended at the age of three months and above for both dogs and cats due to the presence of maternal antibodies against rabies below that age. The observed occurrence of rabies in dogs under three months of age could be a mistake related to poor recording of age and that it is possible that the puppies were much older than the stated ages.

As shown in the current survey, dogs remain the most important reservoir of rabies for human beings and other animal species. Out of the 65 reported cases of rabies, 61 (94%) were dogs. Moreover, the other four animals including two cows, a goat and a cat reported as rabies cases had also been exposed to rabid dogs. The present findings support the previous observations by various workers that domestic dogs are a potential source of rabies to human beings and other animal species (Kitala *et al.*, 1993).

Of much concern, is the occurrence of rabies in previously routinely vaccinated animal. It is observed in the current survey that one dog was found positive for rabies just one month after the date for the annual booster anti rabies vaccination had passed. That suggests that the dog might have been exposed to rabies even before the end of the one year protection period with the rabies vaccine. Nevertheless, factors affecting vaccine potency such as improper handling and poor preservation of the vaccine might have contributed to the failure of protection of the animal in the present study. Several incidences of rabies in vaccinated animals have been reported elsewhere, being associated with rabies related viruses (Foggin, 1988; Rupprecht *et al.*, 1995). Therefore, there is an urgent need for studies aimed at identifying the main rabies isolates in Tanzania in order to match with the type of anti-rabies vaccines used in the country. Proper control of importation of the vaccines should be enforced in order to ensure that only the recommended vaccines are used in the country.

Failure to diagnose rabies basing on the clinical signs by qualified veterinarians pose serious public health problems. The situation is even worse to most personnel handling dogs, in particular children. It has been shown in the records that two rabid dogs were referred from private practices in Dar es Salaam. Furthermore, a report of a dog showing only a sign of hypersalivation for over a month is a big challenge to practicing veterinarians. This further

demonstrates the serious diagnostic problems of rabies associated with atypical rabies cases. It is suggested that dogs showing signs of salivation should be considered as potential candidates for rabies, but careful evaluation to rule out oropharyngeal conditions should be performed (Buoro, 1993). Atypical signs of rabies have also been reported in vaccinated cats whereby Lagos Bat virus was isolated (Swanepoel *et. al.*, 1993). Although only Genotype 1 of rabies virus is reported to exist in Tanzania, the finding of atypical rabies in the present survey strongly suggests the existence of other rabies related viruses in the country.

In the present survey, the most common clinical sign of rabies recorded was aggressiveness, observed in 82% of rabies suspected dogs. Other observed signs included salivation, limb paralysis and atypical rabies observed in 14%, 23% and 20% of the cases, respectively. Signs of aggressiveness in dogs with rabies predominate in the furious form of rabies whereas paralysis is the main predominating sign in dumb rabies (Swango, 1989; Haig, 1977). Furious rabies is reported to occur in about 25% of the rabies cases (Haig, 1977). The higher number of the reported cases of aggressive dogs in the present study, might be attributed to overlooking of dumb rabies cases due to ignorance of most dog owners. This further supports the fact that numerous cases of rabies are not reported for confirmation which leads to serious underestimation of the magnitude of rabies in Tanzania.

Out of the 63 reported rabies cases, only 44 (68%) were confirmed positive for rabies. Occurrence of FAT negative animals might be due to either the presence of other disease conditions with similar signs to rabies or the presence of rabies virus strains that could not be detected by the current FAT technique. Recently, in Morogoro, Tanzania, a dog that showed signs of rabies was found to be FAT negative but positive for Negri bodies on histopathology (Semuguruka, 1999. Personal communication). Similar findings has been reported by Rupprecht (1995), and further genetic studies revealed that the virus involved in the FAT negative, Negri bodies positive case was a rabies related virus of Genotype 4 (Rupprecht *et al.*, 1995), the situation that might have been the case in the present study. No attempts have been made to identify rabies strains in the present study. Since Negri bodies are only detected in about 50% of the rabies suspected cases (CDC, 2000), it is recommended that specimens from FAT negative brain tissues should be preserved and used for confirmation of rabies using other techniques such as mouse inoculation and molecular biology techniques.

In dogs, it is known that once the virus is excreted in the saliva, clinical rabies develops in less than 10 days period. Virus excretion in saliva in natural conditions has been reported in healthy previously unvaccinated dogs (Aghomo *et. al.*, 1989) and in experimental dogs infected with street virus isolates (Fekadu *et. al.*, 1982). In the latter, the virus was detected in the saliva for up to 14 days prior to onset of the clinical signs of rabies (Fekadu *et. al.*, 1982). It has also been suggested that, observation period of rabies suspected dogs should be three weeks and above instead of the current 14 days (Fekadu *et. al.*, 1982). It is therefore, suggested that post-exposure vaccinations should not be linked with the period of confinement of the rabies suspected animals.

## CONCLUSION

The present study has shown that rabies is endemic in the study area whereby domestic dogs are a potential reservoir of infection to other animals and humans. The increasing number of cases of rabies with no signs of change of behaviour is a serious diagnostic challenge to veterinarians. Furthermore, the presence of FAT negative results in dogs with signs typical to



rabies, is worthy investigated. Further studies should aim at identifying the main rabies isolates in Tanzania in relation to the clinical and pathological features in the affected animals. Veterinarians should suspect rabies in both, aggressive and paralytic animals and measures against rabies should be taken accordingly. Campaigns against rabies should be carried out routinely in urban and rural areas in order to control the disease.

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