Epidemiol. Infect. (1998), **120**, 165–169. Printed in the United Kingdom

Rabies in Thailand

C. MITMOONPITAK*, V. TEPSUMETHANON AND H. WILDE

The Queen Saovabha Memorial Institute, Thai Red Cross and WHO Collaborating Centre for Research in Rabies, Rama 4 Road, Bangkok 10330, Thailand

(*Accepted 22 October 1997*)

SUMMARY

The prevalence of canine and human rabies in Thailand has decreased significantly during the last decade. This has been associated with an increasing number of human post-exposure treatments. Educational efforts, mass vaccination of dogs and cats and the use of safe and effective vaccines have all made an impact. The proportion of fluorescent antibody positive dogs, among those examined for rabies averaged 54% indicating that rabies is still a major public health threat. Canine rabies vaccination is not usually performed in animals < 3 months old. However, this study revealed that 14% of rabid dogs were < 3 months old and 42% were $\leqslant 6$ months old. This is the age group most likely to interact with humans and other dogs. Our study also supports the World Health Organization's recommendation that observing suspected rabid dogs for 10 days is an adequate and safe practice.

INTRODUCTION

Canine rabies control measures were first attempted in Thailand in 1913 but have not been effective due to economic, cultural and religious constraints [1]. Human rabies in Thailand is almost always transmitted from dogs. Only in the last two decades has a significant reduction of the number of human cases been achieved. There were 370 reported human rabies deaths in 1980 (0·78/100000) but only 75 in 1996 (0·12/100000). Over 90% of these victims had not been vaccinated and 50% were children < 14 years old.

Community or stray dogs and, to a lesser extent, unvaccinated pet dogs are responsible for sustaining endemic rabies in Thailand. An estimate of the total dog population, carried out on the basis of random sampling in 1992, was 7·6 million equivalent to 1 dog per 6·7 persons or 0·7 dogs per household. This number is thought to have risen to over 10 million by 1996. The ratio of male to female dogs in Thailand is 6/4, and 27% of dogs are < 1 year old. The situation is thus similar to that in Tunisia, another well-studied region [2]. The population of dogs and cats in Metropolitan Bangkok was estimated in 1993 as 400000 and 47000 respectively. There were more male than female animals. This has also been found in other rabies endemic countries [3–6]. A recent survey revealed that 13% of Bangkok households reported owning dogs and that 77% of these animals had a history of rabies vaccination.

The Queen Saovabha Memorial Institute (QSMI) of The Thai Red Cross Society is the principal rabies diagnostic centre for the central region of Thailand and also manages most rabies post-exposure treatment of humans. Fifty-nine percent of all laboratory diagnoses of rabies in Thailand were made at QSMI in 1980, 34% in 1984 and 24% in 1993. This is a retrospective report of the activities of QSMI which may shed some light on the nature and extent of the rabies problem in the central region of Thailand.

* Author for correspondence.

MATERIAL AND METHODS

QSMI accepts live animals, carcasses, and animal as well as human tissue for rabies diagnosis. Owners are interviewed about the medical and vaccination history of the animal as well as of humans or other animals that might have been exposed. The work is closely coordinated with that of the animal bite clinic located in the same compound. A laboratory diagnosis of rabies is made by collecting impression smears from the hippocampus (4 samples) and brain stem (2 samples). These are air dried, fixed in acetone and stored at -5 °C for 1 h. They are stained using fluorescein labelled anti-rabies globulin (Becton Dickinson and Company, Franklin Lakes, USA) at a dilution of 1/120. All brains found negative by the fluorescent antibody (FA) test are tested by mouse brain inoculation using three mice for each brain. Mice are observed for 30 days before being killed. Samples received during working hours can be expected to yield a preliminary report (positive or negative FA test) within 3 h. A final report on FA negative samples is prepared when a mouse has died and is found FA positive or if it is still alive and well after 30 days. Data collected from 1987–96 were analysed retrospectively.

RESULTS

The number of dogs examined in 1987–96 was 24332. Of these 13088 (54%) were FA positive for rabies. A total of 3535 cats were examined during the same years and 15% were rabid (Table 1). Table 2 shows that an average of 14% of dogs examined were < 3 months old and 42% were $\leqslant 6$ months old in 1992–6. Between 1992 and 1996 85% of dogs and 90% of cats examined at QSMI had bitten or scratched one or more human and thus initiated one or more human post-exposure vaccine treatments. Bangkok, with a resident population over 6 million, is divided into 36 districts. Those containing mostly high-rise business buildings and condominiums were found to have a lower prevalence of canine rabies than densely populated areas with individual houses and crowded tenements. Districts with a higher proportion of Muslims than Buddhists also had a lower number of rabies cases. Seasonal differences in the number of dogs found FA positive at QSMI were found with 30–35% occurring during January–March, the hot and dry season.

DISCUSSION

There has been a decrease in canine and particularly feline rabies diagnosed at QSMI over the past decade. There was also an overall decrease in the number of animals examined. QSMI was the principal rabies diagnostic centre until 1990, when most regional hospitals in neighbouring provinces established their own facilities for FA microscopy. This reduced the number of animals examined at QSMI. The percentage of FA positive dogs, however, remained unchanged at average 54% (Table 1). Furthermore, Ministry of Public Health Laboratories from throughout Thailand reported similar findings [7]. The unchanged ratio of rabies positive animals is not surprising because animals submitted represent a selected population, that had either shown signs of a neurological illness or had bitten humans. There has also been an overall decrease in the overall prevalence of canine rabies in Thailand. This follows the same trend as that seen in human rabies (Fig. 1). However, there was an increasing number of people receiving post-exposure rabies vaccination (84178 cases in 1987 to 160448 cases in 1994). Reasons for these trends are thought to be:

1. An educational campaign that emphasizes the need for annual dog and cat vaccination and the importance of seeking medical care following any animal bite.

2. More widespread availability of modern tissue culture vaccines, human and equine rabies immune globulin, and animal vaccines.

3. The abolition of the use of all nervous tissue derived human rabies vaccines in 1992. QSMI had already discontinued use of Semple and suckling mouse brain vaccine in 1987.

4. The development and widespread use of the reduced dose and lower cost Thai Red Cross intradermal postexposure rabies vaccine. This made tissue culture vaccines affordable even to the poorest citizen [8–10].

Forty-two percent of dogs found rabid at QSMI between 1992–6 were $\leqslant 6$ months old, a finding also noted elsewhere [2, 11]. Young dogs are thought to be more active and are also likely not to have been adequately vaccinated. It is general practice in Thailand to vaccinate dogs for the first time at 3 months and 14% of dogs < 3 months examined in our series were rabid. Furthermore, previous studies have shown that one dose of rabies vaccine does not always provide long lasting humoral immunity in

https://doi.org/10.1017/S0950268897008601 Published online by Cambridge University Press

Table 1. *Dogs and cats examined for rabies at QSMI, 1987–96*

	Dog			Cat		
Year	Submitted	Positive	Percent	Submitted	Positive	Percent
1987	4327	2672	62	510	114	22
1988	4110	2449	60	539	98	18
1989	3142	1674	53	431	67	16
1990	2807	1364	49	464	63	14
1991	2471	1175	48	370	46	12
1992	2104	1065	51	308	38	12
1993	1667	839	50	276	35	13
1994	1406	668	48	242	23	10
1995	1188	597	50	194	23	12
1996	1110	585	53	201	28	14
Total	24332	13088	54	3535	535	15

Table 2. *Ages of rabid dogs examined at QSMI, 1992–6*
(Cases where the information was incomplete were not included)

	1992		1993		1994		1995		1996	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
< 3 months	115	27	91	26	46	8	37	8	36	8
3–6 months	93	22	59	17	201	33	136	30	132	31
> 6 months	219	51	196	57	363	59	280	62	264	61
Total	427	100	346	100	610	100	453	100	432	100

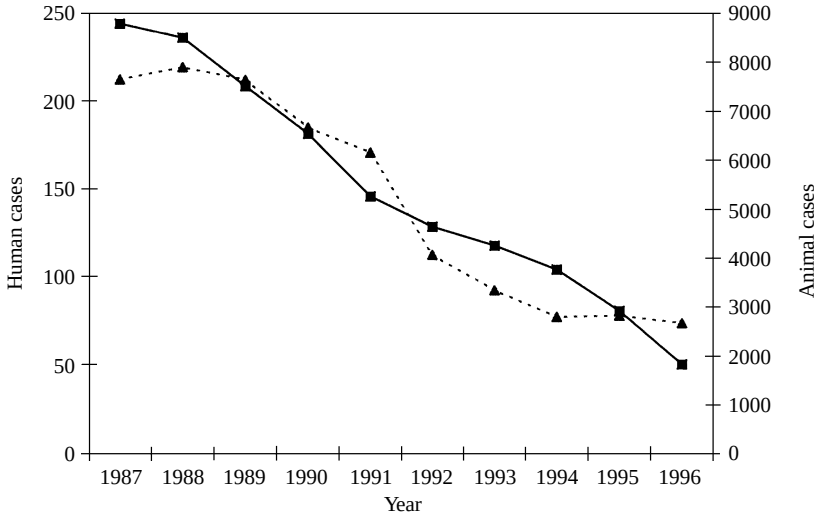

Fig. 1. Human and animals diagnosed rabid in Thailand, 1987–96 human cases (▲), animal cases (■).

dogs [12–14]. Several foreign diplomatic missions in Bangkok have recommended that their staff have their pet dogs vaccinated using the human pre-exposure schedule of one dose on day 0 repeated 1 and 4 weeks later and followed by annual boosters. This is similar to a recommendation made by Norio and colleagues [15] who also recognized that one injection of rabies vaccine may not provide lasting protection. Yasmuth and colleagues reported evidence indicating that 'silent' or barely symptomatic rabies with recovery is also found among dogs in Thailand [16]. This had been previously reported by Fekadu and coworkers

https://doi.org/10.1017/S0950268897008601 Published online by Cambridge University Press

[17]. Such cases are, however, thought to be uncommon and probably play no significant role in the transmission cycle of rabies. The question of how long a dog that has exposed other animals or man should be kept in 'quarantine' is difficult to answer with certainty [18–19]. It is usually recommended as 10 days.

QSMI staff rarely kill dogs and cats that are brought in alive. This is based on Buddhist ethics, which are firmly rooted in Thai culture. This practice allowed us to observe a large number [837] of animals during 1985–96. It has been our experience that all our rabid dogs succumb within 10 days of onset of neurological symptoms. Our findings thus support the current WHO recommendation that observation of a dog for 10 days is a safe practice. We believe that 'dog rabies survivors', as described by Yasmuth and colleagues [16] may have subclinical illness without aggressive behaviour and are simply not detected unless serosurveys are carried out on apparently healthy unvaccinated animals. The prevalence of canine rabies was highest during January to March which is after the breeding season. The relationship between dog oestrus and rabies has been reported in other endemic regions [20]. Public health authorities are aware of this and generally schedule mass dog vaccination campaigns prior to the breeding season.

Much less is known about domestic feline rabies in Thailand. It is likely that feline rabies does not exist as an independent zoonosis but that cats, which appear to be more mobile and live in close proximity to dogs, are incidental victims. A comparison of viral strains among dogs and cats may shed further light on this and is now in progress. We suggest that most feline rabies cases are due to exposure to dogs and that there is only a dog zoonosis in Thailand with the possible exception of one in bats. It is known from previous reports [21] that a few FA positive bats of unknown species have been seen but we are not aware of any surveys or identification of viral strains among bats in Thailand. This is a topic that needs to be studied because there are indications that the European bat rabies strain is spreading and that it is different from the strain used for vaccine production [22–23]. It is apparent that some progress with rabies control has been made in Thailand but the battle is far from won. The large population of stray and community dogs, the fact that they have a short life span and often receive only one vaccine injection, contributes to the rabies problem in this country. Cultural and religious barriers to more radical measures for dog control are also hinderances. Further studies of dog and cat ecology and efforts to learn more concerning better methods of prevention among young dogs are pending. We need to know more about the length of the protection that is passed by a well-immunized bitch to her offsprings and how long it will last. We also need to know how soon and for how long puppies would respond to early vaccination. Similar studies need to be carried out on cats. Thailand has a huge bat population consisting of at least 120 species and, even though human bat bites are rare, they form a potential reservoir and need to be better understood [24].

REFERENCES

1. Prasert T, Malinee C, Pirat P, et al. Rabid dogs in Bangkok-Thonburi, a preliminary study. J Med Assoc Thailand 1972; **55**: 9.
2. Wandeler AL, Matter HC, Kappeler A, et al. The ecology of dogs and canine rabies: a selective review. Rev Sci Tech Off Int Wpiz 1993; **12**: 51–71.
3. Handbook of animal welfare. Westbrook WH, Allen PD, eds. New York and London: Garlan STPM Press, 1979.
4. Beran GW. Ecology of dogs in the Central Philippines in relation to rabies controls efforts. Comp Immunol Microbiol Infect Dis 1982; **5**: 265–70.
5. World Health Organization. Report of WHO consultation on dogs, Ecology studies related to rabies control, Geneva; WHO, 1988.
6. Eng TR, Fishbein DB, Talamante HE, et al. Urban epizootic of rabies in Mexico: Epidemiology and impact of animal bit injuries. Bull WHO 1993; **71**: 485–94.
7. Strategy for Rabies Control in Thailand. Ministry of Agriculture and Cooperation and Ministry of Public Health, 1995.
8. Warrell MJ, Warrell DA, Chantaranich P. Economical multiple intradermal immunization with Human Diploid Cell strain rabies vaccine is effective for post exposure rabies prophylaxis. Lancet 1985; **1**: 1059–62.
9. Chutivongse S, Wilde H, Supich C, et al. Postexposure prophylaxis for rabies with antiserum and intradermal vaccination. Lancet 1990; **335**: 896–8.
10. Wilde H, Chutivonge S. Rabies in Thailand: Economic perspectives and the intradermal vaccine regimen. In: Threanhart O, ed. Rabies in the tropics. London: Wells Medical, 1990; 529–35.
11. WHO. Report of the symposium on rabies control in Asian countries. Jakarta, Indonesia, 1993.
12. Haddad N. Evaluation par le serologie de l'efficacité d'un vaccin antirabique chez des chiens du terrain en Tunisie. Ann Rech Vet 1987; **18**: 63–7.
13. Tepsumethanon W, Polsuwan C, Lumlertdaecha B, et al. Immune response to rabies in Thai dogs: A preliminary report. Vaccine 1991; **9**: 627–30.
14. Sage G, Khawplod P, Wilde H, et al. Immune response to rabies in Alaskan dogs: failure to achieve a

consistently protective antibody response. Trans R Soc Trop Med Hyg 1993; **87**: 593–5.
15. Norio H, Enuh RJ, Mastur ARN, et al. Immune state of dogs injected with rabies vaccine in West Java, Indonesia. Jpn J Vet Sci 1990; **52**: 1099–101.
16. Yasmuth C, Nelson KE, Laima T. Prevalence of abortive canine rabies in Chiang Mai, Thailand. J Med Assoc Thailand 1983; **66**: 169–74.
17. Fekadu M, Shaddock JH, Baer GM. Intermittent excretion of rabies virus in the saliva of a dog two and six months after it had recovered from experimental rabies. Am J Trop Med Hyg 1981; **30**: 1113–5.
18. WHO Expert Committee on Rabies. Prevention of rabies in man. WHO Technical Report Series 1992; No. **824**: 21–6.
19. Compendium of Animal Rabies Control. JAVMA 1992; **200**: 937–40.
20. Malaga H, Lopez Nieto E, Gambirazio C. Canine rabies seasonality. Int J Epidemiol 1979; **8**: 243–5.
21. Prasert T. Rabid bats in Thailand. Prasert T, ed. Rabies. Bangkok; Acksuan Samai Press, 1980: 213–4.
22. Montano-Hirose JA, Lafage M, Weber P, et al. Protective activity of a murine monoclonal antibody against European bat Lyssavirus 1 (BBL 1) infection in mice. Vaccine 1993; **11**: 1259–66.
23. Smith PC, Lawhasaswasdi K, Vick WE, et al. Isolation of rabies virus from fruit bats in Thailand. Nature 1967; 384.
24. Boonsong L, Jeffrey M. Mammals of Thailand. Bangkok; Darnsutha Press, 1988.