THE CORRELATION ANALYSIS AND SPREADING PATTERN OF RABIES CASES IN DOGS AND HUMANS IN TABANAN, BALI FROM 2009-2014

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ABSTRACT

Rabies is one of the most dangerous zoonotic disease because of the high morbidity and mortality rate. This disease is caused by members of the RNA virus genus Lyssavirus, family Rhabdoviridae, order Mononegavirales. Rabies is an acute disease which is transmitted through the bite of rabies vectors. The aim of this study is to determine the incidence of rabies, the area of its deployment and the epidemiological correlation of cases between rabies in dogs and humans in Tabanan, Bali from 2009 to 2014 in spatial term. This study was an observational study using the confirmation method of data on rabies cases, both in dogs and humans. Data were obtained from the relevant institutions. Data were then analyzed, tabulated, and depicted in a map of Tabanan regency from 2009 and until 2014. The result showed that the incidence of rabies in dogs was firstly occurred in Dajan Peken village, Tabanan district, while in human was firstly occurred in Buahan village, Tabanan district. The distribution of rabies was 36 cases in dogs and 18 cases in humans. In addition, the cases of rabies in dogs and humans were spread in 38 villages out of 128 villages in Tabanan. There is a positive correlation between the incidence of rabies evident in dogs and humans (r=0.324; p <0.05).

Keywords: rabies; correlation; dogs; humans; Tabanan Regency
INTRODUCTION

Rabies is one of the most dangerous zoonotic diseases because of its high morbidity and mortality rates. This disease is caused by a member of the RNA viruses genus Lyssavirus, family Rhabdoviridae, order Mononegavirales. Rabies is an acute disease which is transmitted through the bite of rabies vectors to healthy animals or humans. The high mortality rate of rabies infection in humans can reach to 100%, and this occurs when the virus reach the central nervous system (Charkazi, et al., 2013).

Rabies virus is neurotropic, primarily infects the central nervous system of warm-blooded animals. Most of rabies is transmitted through the bite of an infected animals. Mostly, rabies is transmitted by dog, but other research showed that bats can also be a rabies carrier (Muller, et al., 2006).

Rabies was firstly reported on Bali in 2008. The report showed that rabies cases in dogs from 2008 to 2011 had infected 281 out of 722 villages in Bali Province (Batan, et al., 2014). The number of human death cases caused by rabies in Bali from 2008 to 2011 were 133 people. The highest death cases were reported in 2010, which reached 82 cases, and the incidence proportion was 2.1 per 100,000 population. Rabies is one of emerging viral disease in Bali. It was firstly reported in the Kedonganan and Jimbaran villages, South Kuta district, Badung regency on October 12, 2008. Rabies has now spread throughout Bali and causing hundreds of humans and thousand of dogs became victims (Nugroho, et al., 2013).

Balinese people are like getting a dog, the animal is like in everywhere in Bali. Similarly, Tabanan regency which is one of the tourist areas in Bali, with a total population of 495,550 people and 39,610 dogs in 2012. The population of dog was extremely increase and reached 230,000 dogs in 2014 with the estimated vaccination covered 70%. The high dog-to-human population densities in Tabanan will increase the risk of spread of rabies from dogs to humans. This can cause either loss of economic sectors, psychology, tourism and even cause death in humans (Mahardika, et al., 2009).

Rabies cases in Tabanan are strongly believed came from Semenanung Bukit, South Kuta district, due to the failure of rabies control programs. In addition, the rabies cases in dog were relatively high in Tabanan and in 2009 rabies had caused death in human. Rabies began to appear in Bali in late 2008 and then spread wider around the island. It continued to infect humans and caused 122 people died. In Tabanan Regency there were 18 positive cases of rabies infection in humans. Data showed that the only rabies carrier in Tabanan was dog. Rabies was firstly discovered in Buahan village (on August 12, 2009) and then continued to spread toward Kediri village, Timpag village and other 13 villages in Tabanan. After rabies appeared in Tabanan, dog has become the feared animal. In order to control the incidence of rabies, Animal Husbandry Department officials trying to reduce the population of stray dogs in several ways, including quarantine and selective elimination (Putra, 2012).

METHODS

The data that been used in this study were collected from government agencies such as the Department of Animal Husbandry and Animal Health of Bali Province, Health Department of Bali Province, Department of Animal Husbandry of Tabanan Regency, Health department of Tabanan Regency, and the Veterinary Disease Investigation Center Denpasar, report from rabies news and other mass media, as well as interviews with victims of their relatives in regard of their rabies infection in Bali. Field observations were performed to validate the data obtained.

This research was began with the data collection on rabies cases in dogs and humans in Tabanan. Data were then compiled, tabulated and then mapped to determine the spatial spread of rabies in Tabanan. Data analysis was performed using descriptive analysis, normality test (Shapiro Wilk test), homogeneity test (Lavene’s Statistic test) and correlation analysis (Rho-Spearman test).

RESULTS AND DISCUSSION

Rabies cases in Tabanan, both in dogs and humans, were firstly reported in 2009. The initial cases of rabies in dogs were reported from three districts in Tabanan regency, including Tabanan, Kediri, and Penebel. In the same years, the incidence of rabies was firstly reported to infect 13 people in the district of Tabanan, Kediri, Penebel and Kerambitan. In 2010, there were 15 cases of rabies in dogs and 5 cases in humans. Most cases of rabies in dogs were reported from Pupuan (8 cases/53.33%). The number of rabies cases in dogs decreased to become just six cases in 2011, and only one
case in 2012. In 2013, no case of rabies in dog was reported. Rabies case then reappeared in 2014, a total of nine cases were reported infecting dogs. There were no cases of rabies in human reported from 2011 until 2014 (Fig. 1, Fig. 2).

Figure 1: Rabies Cases Fluctuation in Tabanan from 2009 until 2014

Transmission of rabies among dogs in Bali, especially in Tabanan was caused by the bite of an infected dog to healthy dogs. This model of transmission is a sole cause of the rabies outbreak in dogs in Bali, supported by the fact that dog is the major carrier of rabies virus and responsible to the spread of rabies. Other study mentioned that all the fatal rabies cases were carried by dog bites (Jemberu, et al., 2013). The high mobilization of infected dogs toward Tabanan regency has also contributed to the spreading of rabies in this area. In early 2009, rabies just infected six dogs, which increased to become 15 dogs in 2010 (Fig.1). Low protective immunity against rabies virus is believed to contribute of the rabies spreading in the region (Utami and Sumiarto, 2012).
Maintenance system of dogs in Bali is different compared to other regions in Indonesia, which also related to the increase number of rabies cases. Most of balinese people treat their dogs with free ranging system. Only around 5-25% of dogs are usually being released in the yard. These dogs are usually well maintained, and generally purebred dogs. The rest (75-95%) is a free range and stray dogs. These free range and stray dogs are at the highest risk for rabies spreading vector and once these dogs are infected they can also infect both other animals and humans. It is due to high possibilities to contact directly with other rabies carrier animals. As a research reported that the highest incidence of rabies was in stray dogs (81%), followed by free range dogs (17%) and the lowest incidence was in captive dogs (2%) (Putra, 2012). In addition, research data showed that captive dogs have a tendency of 1.59 times to be vaccinated than other dogs (Tagueah, et al., 2012), so the chance of stray dogs to get infected by rabies is higher.

Free range dogs are generally seeking for food in the neighborhood field, residential, shrubs, and around the landfill. At the time of mating season, both free range and stray dogs doing a direct contact with other dogs to mate. The fights among dogs to compete for the females contribute to increase the risk of rabies spreading between animals, because when the dogs fight and bite each other, it is increased the possibility of virus transmission. This is supported by research that found a significant increase on the prevalence of rabies soon after dog mating season in Ethiopia (Tefera, et al., 2002).

High frequency of rabies cases in dogs in Bali is believed to be related with a high population of rabies suspected dogs and the high dogs to humans population ratio in Bali. Yudhisthira Foundation reported that the population of dog in Bali was 540.000 dogs approximately (density of ± 96 dogs/km²). The report also mentioned that the population ratio of
dogs to humans was about 1:6. But another research found that the population ratio of dogs to humans was 1:16 (Mahardika, et al., 2009). The high density of the dog population increases the chance of the interaction between dog and human, which then lead to increasing number of bite cases.

The incidence of rabies in dogs decreased extremely in 2012 with just one case was reported, and no case in 2013. This is believed due to the succeeded of mass vaccination program. However, new rabies cases (9 cases) was appeared in dogs in 2014. Although mass vaccination had suppressed the incidence of rabies until 2013, but it did not succeeded to eradicate the rabies virus in this area (Putra, 2012), as there was an epidemic of rabies cases in 2014 (Fig. 1).

Several studies have shown the impact of high dog population and the population ration of dogs to humans on the increase number of suspected rabid dog bite cases. Globally, high cases of bites by suspected rabid dog can be seen from a report stated that 15 million people have received prophylactic injections of rabies each year (WHO, 2010). This bite cases were mostly caused by stray dogs. The research conducted by Tenzin, et al., (2011) mentioned that bite cases by stray dogs (231/324; 71%) was more than the captive dogs (93/324; 29%) (X^2 = 58.77; P <0.001). This most frequent dog’s bite cases are mainly in human’s lower extremities area, but the bite can also occur in the neck, head or face of the human (Tenzin, et al., 2011).

Table 1: Correlation Analysis between Rabies Cases in Dogs and Human in Tabanan from 2009 until 2014

<table>
<thead>
<tr>
<th>No</th>
<th>Host</th>
<th>Number of cases/year</th>
<th>r</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>2009</td>
<td>2010</td>
<td>2011</td>
</tr>
<tr>
<td>1</td>
<td>Dog</td>
<td>6</td>
<td>15</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>Human</td>
<td>13</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>18</td>
<td>20</td>
<td>6</td>
</tr>
</tbody>
</table>

These research results indicate that there was a significant correlation (P> 0.05) between rabies cases in dogs and humans (Table 1). This is supported by epidemiology theory that the high cases of rabies in dogs, would lead to an increase number of human rabies cases. Similar results published by Dibia (2007) which stated the high density of dog population in Flores is the cause of the high rabies cases in humans.

In 2009, human victims of rabies infection was 13 persons and increased to 15 in 2010 in the Tabanan regency. Then, there were no rabies cases reported in human in the subsequent years. Rabies victims in Tabanan was died mostly due to incomplete exposure treatment against rabies infection. The similar situation was likely happened in China, where the high incidence of rabies in human was caused by the improper treatment of post exposure prophylactic (PEP), inadequate of knowledge about rabies, and the poor quality of rabies vaccine (Si, et al., 2008).

This research also proved that rabies cases in dogs were positively correlated (r=+0.324) with the incidence of rabies in human in Tabanan (Table 1). This indicates an increase in rabies cases in dogs associates with the increase number of rabies cases in humans. However, if the correlation coefficient (r) in this research is compared to previous research conducted by Stantić-Pavlinić and Hostnik, (2002), the incidence of rabies in dogs and humans in Tabanan is lower than correlation coefficient (r) in Slovenia (+0.77).

Results of this study is also supported by several facts which showed that the control of rabies in dogs can significantly reduce the frequency rabies cases in humans. Research found that the declining populations of stray dogs in China, reduced the incidence of rabies in humans in 2007-2011 (Yin, et al., 2012). Other research conducted by Vancelik, et al., (2014) also found that the control of the stray dog population using animal shelters method, could significantly reduce cases of suspected rabid dog bites in Turkey. However unorganized dog eradication in Bali in 2009 tended to contribute to the faster spread of rabies to wider area, because it made the dog exsodus out of the village to other villages (Putra, 2012).

A further study on this research results indicatea that 16.67% of the infected persons in Tabanan were childrens (5-11 years old), adults (26-45 years old) were 44.44%, and the remaining was 38.89% which infected elderly people (45 years old and above). It can be seen that rabies cases in children was lower compared to other age categories. This
finding is different from that of the earlier finding described by Knobel et al. (2005) who reported that children are at the highest risk for infected by rabies than any other age category.

Some of rabies cases in human in Tabanan occured in children aged 6-8 years old was possibly due to the habit of children who tended to play closely to stray dogs, and shared their food with the dogs. This situation is high risk of the dog bites (Kole, et al., 2014). A study also reported that most of children are not aware of being attacked by dogs and their parents seemed to be not concerned on this situation (Knobel, et al., 2005).

Based on the results of this study and previous studies, it can be concluded that the high density population of stray dogs had an impact on the incidence of rabies in dogs, and it correlates with the incidence of rabies cases in humans in Tabanan periode 2009 to 2014. More mass campaign related to the rabies control and prevention program need to be done, including selective elimination of free range and stray dogs, monitoring on rabies carrier animal traffic, strict quarantine policy and also public socialization about rabies. Rabies carrier animal traffic monitoring becomes very important to be consider because of the high mobility rate of people and dogs have a significant effect on the increase rate of the spread of rabies. One research reported that around 10% of the rabies infected dogs move from one village to other villages each year in Bali (Dewi, 2012).

However, a study showed that an effective vaccination program is a major factor in the effort to eradicate rabies (Dibia, 2007). This is also stated by research mentioned that from 408 cases of human rabies were reported in 2003-2007 in Shandong Province, China, its known that they were generally infected by their own captive dogs which had not been vaccinated against rabies (Wang, et al., 2010). Minimum vaccination coverage to suppress transmission of rabies was 70% in 2009 (WHO, 2010). But the vaccination coverage in Bali was just about 45%, making the spread of rabies was unstoppable. However, in 2012 the vaccination coverage its said to be reached 75%, which contributed to decrease the spread and the cases of rabies (Putra, 2012).

CONCLUSION

Based on data analysis of rabies cases in dogs and humans in Tabanan from 2009 until 2014, it can be concluded that there were 36 cases of rabies in dogs and 18 cases in humans. The cases distributed in 38 villages out of total 128 villages in the Tabanan District. there was a significant correlation (P> 0.05) between rabies cases in dogs and humans, which mean an increase of rabies cases in dogs followed by an increase number of human rabies cases.

SUGGESTION

Further research on the relationship between the incidence of rabies in animals and humans with their risk factors analysis are needed. These risk factors that may need to be evaluated including the dogs population, ratio of dog to humans population, rabies vaccination rate, dogs and humans mobilization, and other related factors. The accurate data on the epidemiology and risk factors that involve in the spreading of rabies, may help to create an appropriate prevention program, especially in Tabanan regency.
REFERENCES


