ANTHRAX RECURRENCE IN SUMBAWA ISLANDS, WEST NUSA TENGGARA PROVINCE

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ABSTRACT

An interview survey was carried out to collect data regarding the reccurent anthrax in Sumbawa Island, West Nusa Tenggara Propince. The data collection aims to scrutinize possible factors atttibutable to the repetitieve anthrax incidents in this island. From the data, it is found that the geographical environment, rearing system, people attitude toward anthrax and limited capital resource are factors that are likely attributable to the recurrent anthrax in Sumbawa Island. The anthrax bacillus thrives in the alkaline soil of Sumbawa Island. The disease transmission is exacerbated by the open grazing system that eases the transmission. Mean while, due to limited resource, vaccination as an effective tool to suppress anthrax incident has not been able to cover the minimum population coverage for an optimum result. Furthermore, geographical constraints such as mountainous and distant location from livestock office also contribute to the recurrent anthrax in this island.

Key words: Antharx, environment, rearing system, vaccination

INTRDUCTION

Sumbawa island that consist of three districts (Sumbawa, Dompu and Bima) has experienced a long history of anthrax. The first incident was reported in the 1960-es in Bima but there was no data on the victims (MASHUR *et al.,* 2004). In the subsequent year, anthrax kept reoccurring with the interval of 2 - 7 years (DINAS PETERNAKAN BIMA, 2005). Antharx in Sumbawa Island has caused great losses both due to its fatality in animals and its zoonosis impact in human. The economic loses were due to animal death and decreased meat and hides stock (NOOR, 2001).

The biggest anthrax outbreak occurred in 2003 in Doridungga village, Bima District. In this outbreak, this deleterious disease attacked 67 goats, taking 9 lives and putting 15 people in hospital (MASHUR *et al.,* 2004). The last reported attacked was in the early 2005 in Sumbawa and Ropang Sub District (Sumbawa District) affecting 2 cattle with no human victims (DINAS PETERNAKAN SUMBAWA, 2005).

Though Sumbawa Island has experienced a long history of anthrax, this disease is likely to keep occurring. The recurrence is possibly caused by the nature environment of the island that nurtures the disease agent. Moreover, lack of technology and sources available to detect and control anthrax are also possibly attributable to rapid spread of the diseases agent. Other possible weak points in suppressing anthrax incidents might be in methods applied to over come, prevent and control this disastrous disease.

Therefore, this paper aims to review anthrax by addressing the occurrences in Sumbawa Island. Another aim is to seek contraints encountered in Sumbawa island in deterring the disease incidents.

DISCUSSION

Etiology and biology

Anthrax is an acute, febrile disease of all warm blooded animals, including man caused by Bacillus anthracis. B. anthracis is a gram positive, non motile, spore forming bacteria of relatively large size (4-8 x 1-1,5 µ) (AMSTUTZ *et al.,* 1986). Spores are formed when materials containing anthrax basils are exposed to the air and are resistant to most external influences including the salting hides, normal environmental temperatures and standard disinfectants (BLOOD *et al.,* 1983). The spores may persist for long periods in dry products such as feed, animal by products or in soil

(AMSTUTZ *et al.,* 1986). A report states that the spores are capable of remaining viable in soil up to 60 years (BEVERIDGE, 1983), particularly in the presence of organic matter, in an undrained alkaline soil and in a warm climate (BLOOD *et al.,* 1983).

The biology of B. anthracis, the causative agent of anthrax might contribute greatly to the lethal impacts of this disease. This bacteria has two virulent plasmids, pXO1 and pXO. pXO contains genes that encode tripartite exotoxin, consisting nof the components protective antigen (PA), edema factor (EF) and lethal factor (LF). PA along with EF produces edema whereas the combination of PA and LF is lethal to susceptible animals (SASTRY *et al.,* 2003) causing tissue damage, terminal anoxia mediated by the central nervous system and death resulting from shock and acute renal failure (BLOOD *et al.,* 1983).

Post anthrax spores exposure, he spores germinate in the tissue at the of entry and grow as vegetative organisms (JAWETZ *et al.,* 1989). Infection may occur through the intact mucous membrane, defects in the epithelium arround erupting teeth or scratches from tough, fibrous food materials. Post entry, the bacteria are moved to the local lymph nodes by local phagocytes. After proliferation in this site the bacilli pass via the lymphatic vessels into the blood stream leading to septicaemia with massive invasion of all body tissues (BLOOD *et al.,* 1983).

Epidemiology

West Nusa Tenggara Province that consists of two main islands i.e. Lombok and Sumbawa is in the list of anthrax infected province in Indonesia. Anthrax prevalence per one million livestock in this province is 70, a somewhat high figure compared to other region such as Sumatra, Java, Sulawesi and East Nusa Tenggara, where the anthrax prevalence accounts for 2.1; 5.3; 0.9; and 35.6 respectively (NOOR *et al.,* 2001). Many animals and people have succumbed to this disastrous disease (complete list of victims is shown in the appendix). Though BLOOD *et al,* (1983) states that anthrax mainly occur in cattle and less frequent in goats, most recorded cases in Sumbawa Island were in goats (155 cases) followed by cattle (17 cases) and buffalo (16 cases).

It is very likely that the nature environment of Sumbawa island and the ecology of B. anthracis play important roles as determinant factors in the recurrent incidence of anthrax in WNT. Another predisposing factors are rearing system and people attitude toward anthrax.

Nature and environment contribute significantly to the nurture anthrax spores remain viable. JAWETZ *et al,* (1989) mention that alkaline soil conditions, organic matter availability and warm weather condition maintain anthrax spores remains active for more than 50 years. While BLOOD *et al,* (1983) states anthrax outbreak originating from soil borne infection always occur after a major climate change such as heavy rainfall after prolonged draught. Most of these factors are true for Sumbawa island. A vast majority of the island is covered by clayed soil that has alkaline pH (DINAS PETERNAKAN SUMBAWA and BIMA, 2005). Moreover, Sumbawa island experiences long dry season (NULIK *et al.,* 2000). This condition are very likely favorable for anthrax spores to survive and reoccurring in a conducive condition.

As consistent as BLOOD *et al,* (1983) and also in agreement with HARJOUTOMO *et al*, (2002), a majority of anthrax attacks in Sumbawa island emerge during long dry season (DINAS PETERNAKAN SUMBAWA, 2005) or during the weather exchange, eather at the and of wet season entering the dry season or vice versa (DINAS PETERNAKAN BIMA, 2005). This could be understood since in the late wet season to dry season, forage are usually scarce, mainly stalk remain in the field. Accordingly, animals are forced to graze down to the stem that is apparently close to the soil where anthrax spores may reside. This could be exacerbated if the hard forage erodes or injures the mouth skin/mucosa of the animal. The incident of this deadlu disease in creases in sparse pasture due to the increased possibility of contaminated soil ingestion. Moreover, injury of the oral mucosa is attributable for invasion of the microorganism to animals (BLOOD *et al*., 1983).

On the other hand, anthrax incidence in the eraly wet season possibly because animals graze in young pastures which is still reasonably close to the soil. After a long dry

season with forage scarcity, animals tend to graze greedily in this just growing pasture where the grass might be contaminated by anthrax spores. As a result, animals can get exposed after grazing.

A part from weather and soil, geografhical and environmental conditions also seem to contribute to the transmission and the recurrent incidents of anthrax in Sumbawa island. Hilly and deforestation have obviously drawn anthrax spores from higher land to the lower one. Data shows that in 2004 in Sumbawa district, anthrax attacked four villages in Moyohulu, infecting 2 cattle, 6 buffalo and 7 people. In the same time, this disease also occurred in Moyohilir sub-district downstream (DINAS PETERNAKAN SUMBAWA, 2005). It was highly suspected that anthrax spores in Moyohilir were from Moyohulu since there is a river flowing from Moyohulu down to Moyohilir. Moreover, the infected villages in Moyohilir are in the riverside. The infected animals might have drunk in the contaminated river.

Meanwhile, deforestation leading to erosion might have up turned the anthrax spores from its grave. This can be seen from anthrax attacks in several villages that have never been recorded before. BLOOD *et al*, (1983) mention, in an anthrax outbreak, there are two possible sources of infection. The first is anthrax spores from soil turn up in anthrax grave. The secondary source is discharge from other infected animals that still agile just before that.

Rearing system is another issue attributable to the reoccurrence and transmission of anthrax. A great majority of livestock are grazed in open land with no fences between owners (DINAS PETERNAKAN BIMA, 2005). In Sumbawa district, the government provides communal grazing land (called Lar system) where animals from different ownership graze in the same place (DINAS PETERNAKAN SUMBAWA, 2005). These systems could ease the disease transmission among animals in that flock. This can be worse during the dry season when water is limited and only available in certain ponds. All animals will come to drink in the same pond. If there were animals contracting anthrax, that would be disastrous.

Meanwhile, transmission of anthrax to human in Sumbawa was commonly from consuming infected meat. Only few cases showed people got infected after salting the hides of infected animals (DINAS PETERNAKAN BIMA, 2005). Other case revealed a farmer becomes infected after wearing a hat from pandan leaves, planted in the contaminated land. The unawarences of lay people in remote villages seems to increase the possibility of anthrax in human. A report said, when anthrax took 9 human's life in Donggo, it was because the owner of the infected goat slaughter and sonsumed the sick animal. They really valued their livestock and were reluctant to discard the sick animals. Even worse, the owner shared the infected meat to neighbors and families. As a result, 9 people succumbed to such disease (DINAS PETERNAKAN BIMA, 2005).

Clinical signs

Many cases of anthrax in Sumbawa Island showed acute/per acute from with sudden death of affected animals. Clinical signs frequently were not observed. Several cases revealed excitation, blooded discharge in anus, mouth, muzzle, ears and genital external. Severe dysponea, swollen neck extending to the chest, flank and genitalia were also observed. In affected goats, the animals cry loudly before died (DINAS PETERNAKAN BIMA, 2005). These clinical signs were similar with findings reported by GAMBY *et al*, (2005).

Meanwhile, human anthrax in Sumbawa islands was reported to reveal in three forms (cutaneous, alimentary and respiratory form. In the cutaneous form, the infection started as vesicule developing into curbuncle, while people with alimentary anthrax contracted diarrhea leading to dead in 1 – 3 days. And people with respiratory anthrax died due to severe dyspnoea (DINAS PETERNAKAN BIMA, 2005). This fact is quite contradictive with NOOR *et al*. (2001) who state that 95% of human anthrax is in cutaneous form. This may be because people in Bima consumed the sick animals and did not have proper treatment post infection.

Diagnosis

A part from clinical sign of sudden death, most anthrax incidents in Sumbawa Island

were presumptively diagnosed by Giemza staining of blood smear from the suspected animals. In order to confirm the diagnosis, specimens (blood and soil) were also sent to the appointed laboratory diagnosis (Research Institute Veterinary Science in Bogor or Disease Investigation Centre in Bali) (DINAS PETERNAKAN BIMA and SUMBAWA, 2005). However, blood smear test might be not reliable since characteristics of B. anthracis are closely related to B. mycoides, B. cereus and B. thuringiensis (SASTRY *et al*., 2003). Moreover, not all sudden death is caused by anthrax. Poisoning also shows sudden death symptom (NOOR *et al*., 2001).

Rapid and accurate diagnosis plays an imprtant role in combating anthrax. This is because the respected livestock office is not allowed to take any administrative actions regarding anthrax prior to the appointed laboratory diagnosis (Veterinary Research Institute in Bogor or Disease Investigation Centre in Bali) (DINAS PETERNAKAN BIMA, DOMPU, SUMBAWA, 2005). Unfortunately, Bogor is distance from Sumbawa island. As a consequent, the confirmatory result of laboratory diagnosis could take a long time. This could hamper the livestock office actions in encountering such disease. Furthermore, DIC Bali as the nearest appointed laboratory does not permit any anthrax suspected specimens, therefore all specimens should be sent to Bogor.

For a rapid and simple laboratory diagnosis of anthrax, SASTRY *et al*, (2003) introduced a method using specific protective antigen (PA)-reactive mAb-based dot ELISA for the confirmation of toxin-producing strains of B. anthracis. For the demonstration of PA toxin, these researchers used Cossamino medium by omitting the carcoal content. They state that conventional methods (smears and cultural characteristics) may not always be typical 1. The motility test, one of the most useful procedures for preliminary screening of Bacillus isolate could be misled after the finding of motile B. anthracis strain from China. While the gamma phage lysis assay and Fluorescent Antibody staining of the suspect culture has cross reaction with B. megaterium. SASTRY *et al.* (2003) clain that all these limitation sould be eliminated using m Ab dot ELISA technique as it is relatively simple to perform, specific and safer SASTRY *et al*. (2003).

Treatment and control

In the course of anthrax attack, the respective Livestock Office in Sumbawa Island has taken several actions including: closing the affected villages, vaccination in the affected villages, ring-antibiotic, treatment for animals in the neighboring villages followed by vacination after 2-3 weeks and also river sweeping down stream from the affected villages (DINAS PETERNAKAN BIMA and SUMBAWA,, 2005). GARBY *et al*. (2005) state that antibiotic theraphy in animals appearing to be affected or having high temperatures gives positive response to stop septicaemia if given early.

Though anthrax is a lethal disease, it is a disease that effective vaccine is available that may be used to help reduce the associated potential death loses (DALY, 2005). This is in agreement with HARDJOUTOMO *et al*, (2002). For maximum immunity, animals should be vaccinated 2-4 weeks before exposure to pasture (DALY, 2005). The vaccine provides protective immunity starting about 3-5 days following vaccination (GARBY *et al*, 2005). Animals are belleved to have at leat 6 months and possibly to a year of solid immunity from one vaccination dose (DALY, 2005).

Despite the annual vaccination that has been carried out in Sumbawa, this island still encounters recurrent anthrax due to several problems. Limited capital resource is one of the classical problems so that vaccination was not able to cover all susceptible animals. In order to obtain the optimum result of vaccination, at least 80% susceptible population should be vaccinated. By contrast, in Bima, there was only 40.000 dose vaccine available out of 90.000 populations of cattle and buffalo. The conditon is worse in Sumbawa District where the local government does not allocate any budget for anthrax vaccination starting this year (DINAS PETERNAKAN BIMA, SUMBAWA, 2005). This is contra productive since Sumbawa is known as cattle stock point in Indonesia. Anthrax in this island could jeopardize the cattle trade which in turn will have detrimental effects on

farmers. Therefore, the government should pay more attention on this issue.

CONCLUSIONS

The geopraphical environment, rearing system, people attitude toward anthrax and limited capital resource are factors that are likely attributable to the recurrent anthrax in Sumbawa island. The anthrax bacillus thrives in the a;la;ine soil of Sumbawa Island exacerbated by the open grazing system that eases transmission of this disease. Furthermore, limited source for vaccination and geographical constraint also contribute to the recurrent anthrax in this island.

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APPENDIX

Data on antrhax cases in Sumbawa Island

Sumbawa district

No.	Year	Sub District	Village	Victims			
				Cattle	Buffalo	Goats	Human
1.	1997	Sumbawa	Brang Biji	1	-	-	2
2.	1998	Sumbawa	Kerekeh	1	-	-	2
3.	2002	Ropang	Lenagguar	1	-	-	6
4.	2004	Buer	Pernang	1	-	-	-
5.	2004	Moyo Hilir	Ngeru	-	1	-	3
			Batu Bangka	1	5	-	4
			Berare	3	2	-	2
6.	2004	Moyo Utara	Penyaring	1	-	-	-
7.	2004	Moyo Hulu	Batu Tering	-	2	-	-
			Lito	1	2	-	4
			Pelita	1	-	-	-
			Pernel	-	1	-	-
			Sebasang	-	1	-	3
8.	2004	Labuan Badas	Karang Dima	1	-	1	-
9.	2004	Ropang	Tatebal	1	-	-	7
10.	2004	Empang	Empang B	-	1	-	-
11.	2005	Sumbawa	Raberas	1	-	-	-
12.	2005	Ropang	Dsn. Gunung Sari, Tatebal	1	-	-	-
Total				15	15	1	33

*Victims is bold succumbed to antrhax, DINAS PETERNAKAN KABUPATEN BIMA 2005

Dompu district

No.	Year	Sub District	Village	Victims			
				Cattle	Buffalo	Goats	Human
1.	1982	Pajo	Lepadi	-	-	1	2
2.	1986	Hu'u	Daka	-	-	1	-
3.	1992	Pajo	Lepadi	-	-	1	2
4.	2000	Dompu		1	-	-	-
5.	2003	Pajo	Sune	1	-	-	-
Total				2	-	3	4

DINAS PETERNAKAN KABUPATEN DOMPU 2005

Bima district

No.	Year	Location	Victims			
			Cattle	Buffalo	Goats	Human
1.	1977	Monta	-	-	1	2
2.	1978	Madapangga	-	-	1	-
		Wawo	-	-	1	-
3.	1980	Belo	1	-	1	-
4.	1982	Donggo	1	-	1	7
5.	1987	Wawo	-	1	-	-
6.	1995	Wawo	-	-	6	-
		Sape	-	-	1	-
		Bolo	-	-	4	-
		Wera	-	-	1	-
7.	1997	Woha	-	-	1	-
		Belo	-	-	1	-
		Wawo	-	-	1	-
		Sape	-	-	4	-
8.	1998	Wera	-	-	5	-
		Wawo	-	-	3	-
		Belo	-	-	2	-
		Woha	-	-	1	-
		Bolo	-	-	2	-
9.	1999	Wera	-	-	12	-
10.	2000	Wera	-	-	4	-
		Wawo	-	-	1	-
		Belo	-	-	1	-
11.	2001	Wera	-	-	4	-
		Sape	-	-	1	-
		Donggo	-	-	2	-
		Ambalawi	-	-	3	-
12.	2002	Wera	-	-	3	-
		Monta	-	-	2	-
		Bolo	-	-	2	-
		Ambalawi	-	-	2	-
		Sape	-	-	1	-
		Madapangga	-	-	2	-
		Donggo	-	-	1	-
		Sanggar	-	-	1	-
13.	2003	Donggo	-	-	63	9
		Sape	-	-	1	-
		Wawo	-	-	1	-
		Monta	-	-	1	-
14.	2004	-	-	-	-	-

DINAS PETERNAKAN KABUPATEN BIMA 2005