

History of Asian Medicine

How not to fight a rabies epidemic: a history in Bali

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Bali, an island, should never have been afflicted with canine rabies, but in 2008 a lack of surveillance allowed the import of an unvaccinated rabid dog from Flores, a distant island where canine rabies was similarly introduced in 1997 and has since become endemic. The initial rabies outbreak on Bali occurred in a remote village at the end of an isolated peninsula, but five months elapsed before the outbreak was officially recognized. Even then, rabies had yet to escape the peninsula. However, Bali officials relied on exterminating dogs as their primary control strategy, did not vaccinate enough dogs on the neck of the peninsula to keep the outbreak confined, prevented nongovernmental organizations and private citizens from vaccinating dogs until approximately a year after the outbreak started; used unreliable indigenous vaccines of only short-term potency, killed vaccinated dogs, and repeatedly disregarded the advice of visiting rabies control experts. Two years after the outbreak started, 44,000 people had received post-exposure vaccination after suffering bites from suspected rabid dogs. The number of human rabies deaths had doubled each six months since the first death occurred.

Keywords: Dog control, immunoglobulin, method for culling, rabies, vaccines, vector dogs

The following narrative, compiled approximately two years after the arrival of canine rabies in Bali, will often contradict the official records and positions of the Balian and Indonesian public health and agriculture departments. The facts, however, are all matters of public record, documented by Balian and Indonesian news media; the archives of ProMed, the electronic bulletin board of the International Society for Infectious Diseases; the Bali Animal Welfare Association; and the archives of *Animal People*, the internationally distributed independent newspaper covering animal welfare worldwide.

Circa May 2008, a 32-year-old taxi driver, named Thomas Aquino, is believed to have emigrated from Flores to Ungasan village, South Kuta, Bali, with his friend Freddy, who has never been fully identified, and their dog [1].

Canine rabies has raged in Flores, another island province of Indonesia, since 1997. The Flores rabies control strategy has focused on exterminating dogs, and sometimes also cats and monkeys. Reducing the

Flores dog population by approximately two-thirds has conspicuously failed to extinguish the rabies outbreak. Comparatively little effort has been made to vaccinate Flores dogs [2, 3]. Figure 1 shows known human rabies cases in Bali 2008-2010.

Dogs are eaten on Flores. Apparently to avoid inhibiting the commerce in dog meat, the Flores authorities have not imposed effective controls on the translocation of dogs. Thus Thomas Aquino and Freddy were able to leave Flores with an unvaccinated dog who had already contracted rabies, but had not yet exhibited active symptoms.

In July 2008, the dog from Flores bit both Freddy and Thomas Aquino. Because there was no effective rabies surveillance program in Bali, no one took note when the dog died of rabies. No effort appears to have ever been made to identify other humans and animals with whom the dog may have had contact [4].

Within a matter of days a three-year-old boy, named Ketut Tangkas, was also bitten. Ketut Tangkas died on December 30, 2008. Bali news media detailed his father's frantic and fruitless search for post-exposure vaccination, after realizing that his son might have rabies. Father and son were turned away from

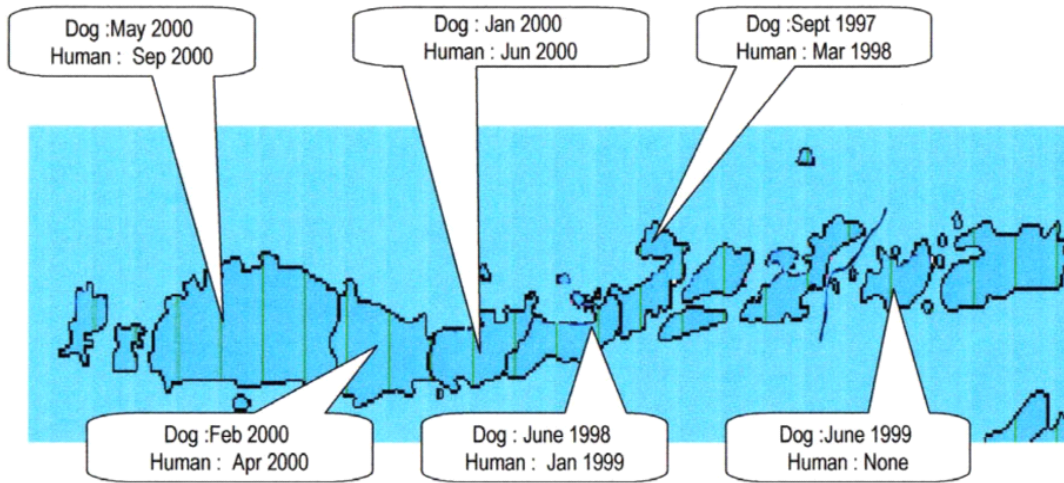


Fig. 1 Date of first appearance of dog and human rabies on Flore.

a succession of clinics and hospitals. None of the medical personnel appeared to believe that Ketut Tangkas could have rabies, though eventually he exhibited all of the classic symptoms. To this day, his death is not officially recognized as a death from rabies [Dan D, Wilde H, personal communication].

Thomas Aquino developed active rabies symptoms on December 14, 2008, but lived until January 17, 2009. Freddy had obtained post-exposure vaccination in November 2008, and lived (**Fig. 2**).

The Asia for animal welfare conference was held at Sanur Beach, Bali, during the last week of August

2008 and the first week of September, just on the opposite side of the Denpasar International Airport from where rabies had begun to spread, unchecked and unnoticed, through the isolated Balian southern peninsula. The Asia for Animals conference spotlighted the work of the Bali Street Dog Foundation, the Yudisthira Foundation, and the Bali Animal Welfare Association, who among them had sterilized more than 20,000 street dogs during the preceding decade, primarily in the densely populated tourist areas south and east of Denpasar, the Bali capital.



Fig. 2 A day's work culling dogs in Bali.

The three privately funded nonprofit animal welfare organizations had not been allowed to vaccinate any of the dogs. In fact, the Bali government had long ago forbidden the import of anti-rabies vaccines, in the mistaken belief that the vaccines could spread rabies instead of preventing it. Thus, the opportunity was lost to have created, in advance of any outbreak, a vaccinated dog population to serve as a barrier between the location of the first rabies cases and the rest of Bali [5]. The Asia for Animals conference brought to Bali more than 200 of the leading experts in animal population control and zoonotic disease control in Asia. Among them were Blue Cross of India chief executive Chinny Krishna, who engineered the eradication of rabies from the city of Chennai, Visakha SPCA founder Pradeep Kumar Nath, who eradicated rabies from the city of Visakhapatnam; representatives of Help In Suffering, the organization that eradicated rabies from the city of Jaipur, and General Rammehar Kharb, chair of the Animal Welfare Board of India, who is energetically pushing cities throughout India to emulate the strategy of vaccinating and sterilizing dogs that succeeded in Chennai, Visakhapatnam, and Jaipur after decades of aggressive extermination efforts had failed [6]. The Asia for animal conference organizers made every reasonable effort to invite Bali officials to attend, as non-paying conference guests, to take advantage of the assembled expertise. None are known to have put in more than a token appearance. Failing to take advantage of visiting expertise was to become a pattern, but because of the described failures of surveillance-the rabies outbreak was at the time still unidentified.

Four more residents of the Ungasan village area suffered bites from rabid dogs in September 2008. The first officially recognized rabies fatality was Putu Linda (46 years old), who died on September 17, 2008. Little if any effort appears to have been made to identify the source of infection. Only after three more victims died within a two-week span in November 2008 did Bali officials acknowledge that a rabies outbreak was underway [7].

The Bali Animal Welfare Association (BAWA) on November 30, 2008 appealed to *Animal People* for information and introductions that might help in combatting the rabies outbreak, which had not yet spread off the southern peninsula. Overnight *Animal People* e-mailed to BAWA the rabies control manuals of the (US) National Association of Public Health

Veterinarians, World Health Organization, Animal Welfare Board of India, World Society for the Protection of Animals, et al. This material was quickly on the desks of the relevant Bali officials. *Animal People* also introduced BAWA to half a dozen of the leading rabies control experts worldwide, all of whom immediately volunteered their assistance. There was unanimous agreement that Bali needed to intensively vaccinate dogs throughout the southern peninsula region and the adjacent mainland, so as to first isolate the outbreak and then eradicate it. This recommendation was completely ignored [8]. But it is not true that all Bali officials did nothing about the rabies outbreak. As the *Jakarta Post* reported on January 19, 2009, "Scores of high-ranking Badung officials participated in a religious ritual at the Puncak Mangu temple to seek divine intervention to stop the outbreak. They have also reportedly planned a series of purification and sacrificial rituals with a similar aim in the coming weeks." In February 2009, a gathering of Bali officials attempted to rid the island of rabies by setting small offerings adrift on wicker rafts.

In addition, even though only rare instances of monkeys transmitting rabies to humans have ever been documented anywhere, Bali officials have from first recognition of the rabies outbreak killed as many dogs as possible in the vicinity of the 48 monkey temples on the island. Efforts have also been made to capture and vaccinate monkeys. The monkey temples are among Bali's major tourist attractions. The focal concern is that rabid dogs might infect the monkeys, though monkeys and dogs normally avoid each other, and that infected monkeys might then infect tourists - although most tourists have much more opportunity and inclination to pet a dog than to approach a monkey [10].

Gautret et al. [9] reported "Since 2008, when the outbreak of rabies in Bali began, 45 returning tourists have attended GeoSentinel or EuroTravNet sites for post exposure rabies prophylaxis. This represents 12.6% of all travelers seen for PEP in all network clinics of Europe during the same time period..." Interestingly, these data demonstrated that the majority of animal-related injuries in travelers returning from Bali were associated with monkey and not dog bite exposures [10]. Despite the intensity of concern about monkeys as a possible rabies vector on Bali, there is still no evidence of monkeys either becoming rabid or transmitting rabies on the island. While the Bali authorities concentrated on rituals and monkey

business, panic-stricken residents of afflicted communities in the south, even on the southern peninsula, welcomed dog meat traders who trapped and translocated hundreds of dogs to restaurants on the north coast of Bali—the far side of the island. BAWA volunteers followed and photographed the traders, but the Bali authorities made no effort at all to stop the translocations. By October 2009 rabid dogs were found on the north coast, near the most famous dog meat restaurants [11].

From first recognition of rabies on the island, Bali authorities have attempted to exterminate dogs in the immediate vicinity of each recognized outbreak - especially in the vicinity of human deaths, disregarding that the exposure leading to each death occurred weeks or months earlier and not necessarily near their homes. The emphasis on extermination intensified in February 2009, through the involvement of an Australian veterinarian representing the New South Wales Department of Primary Industries. Her previous experience in Bali appears to have been in connection with combating H5N1 avian influenza. H5N1 in Bali, as elsewhere in Southeast Asia, is believed to have moved from place to place through commerce, particularly, of live gamecocks. However, the H5N1 control strategy ignored the need to contain cockfighting, and instead emphasized “stamping out,” any birds who might have been exposed to infection. Advocating a similar approach to dealing with rabies, they eventually devised a method of using blowpipes

to deliver a deadly dose of strychnine (**Fig. 3**). In several published papers, the Australian team was critical of the failure of the Indonesian government to bring an end to the Flores rabies outbreak. Yet the methods that were advanced in Bali were essentially the same as what had failed in Flores 8 years before [12, 13]. Limited vaccination was initially done only in the areas where rabies cases were known to have occurred. For most of 2009 the government vaccination effort used low potency vaccines of Indonesian manufacture which were believed to require revaccination after only six months, meaning that the entire vaccination campaign had to be continually repeated. Lack of coordination between the vaccination teams and dog poisoning teams made matters worse, as vaccinated dogs were frequently poisoned, leaving habitat open to unvaccinated dogs from areas with rabies. BAWA, from November 30, 2008 until approximately one year later, repeatedly attempted to obtain government permission to import three-year vaccines and do intensive dog vaccination, under a memorandum of understanding which would ensure that vaccinated dogs would not be killed in poisoning sweeps. Failing to secure the necessary memorandum of understanding with Balian provincial agencies, BAWA eventually began working at the regency level instead, vaccinated more than 80% of the dogs in Gianyar regency, and as of the beginning of June 2010 is moving to do likewise in Bangli regency.



Fig. 3 The strychnine dart being prepared in Bali.

At the end of January 2010, many of the world's leading rabies control experts flew to Bali to present a three-day seminar on rabies control. The seminar took place on the campus of the medical college and was generously sponsored by a Thai NGO (Act Now, Animal Fund). It covered a wide range of topics including epidemiology, pathophysiology, diagnosis, immunology, treatment and control of vectors. Everyone in Bali with a central role in combatting the rabies outbreak as well as university faculty and students were invited to attend at no cost. Any immediate visible impact of the seminar on government policy was, unfortunately, just about nil.

As of May 17, 2010, the Bali government claimed to have vaccinated about 294,000 dogs, believed to be about two-thirds of the island dog population, and to have killed about 81,130, approximately 18%. Because of the use of short-term vaccines, the effective vaccination rate may be considerably lower than the number of dogs who have received protective vaccination at least once. Only the 60,000 dogs vaccinated by BAWA using imported high potency vaccines can be considered to have been vaccinated well enough to contribute to building the vaccination rate in excess of 70% that will be necessary to stop the rabies outbreak [15]. Because the rate of dog killing is less than both the normal mortality rate among Bali dogs and the normal rate of survivorship among litters, the killing cannot really be considered to have accomplished anything other than the maintenance of dogcatchers on the government payroll. One dogcatcher has reportedly died of rabies contracted on the job, indicating that pre-exposure vaccination of workers at risk has either been neglected or was ineffective [16].

Bali legislators have recently urged that the effort to poison dogs should be escalated, because of the increasing drain on the provincial treasury resulting from repeated purchases of post-exposure vaccine. Despite the mounting expense, however, the administration of post-exposure vaccination has been demonstrably uneven and often difficult to obtain. On May 24, 2010, Government spokesperson Ketut Teneng told the *Bali Times* that 44,000 people had received post-exposure vaccination but at least 11 people died after either seeking but not receiving post-exposure vaccination, or receiving it only after delays apparently occasioned by shortages of post-exposure vaccines. Bali news media at this writing have identified 56 human rabies victims. Ketut Tenang

acknowledged 57 human rabies deaths, of whom 26 were confirmed by post mortem testing as rabies deaths. Bali news media have repeatedly alluded to deaths of additional rabies victims in remote areas who have never sought treatment and whose remains have been cremated without testing. Counting these alleged but undocumented deaths, the human rabies toll at the end of May 2010 may be more than 80. And it is still increasing [17].

Of the human victims identified by Bali news media, eight died or were known to have become infected within six months of the death of the dog that bit Thomas Aquino. Another 22 people died in 2009 and 26 in the first five months of 2010 (**Table 1**).

It is with some hope that we have heard news reports from Bali that the government is now looking into mass and sustainable dog vaccination and will stop the indiscriminate culling. On 15 June, 2010, almost two years after the first human rabies death, the *Bali Times* stated that the government has appropriated one million US dollars for human vaccine procurement. This is after 60 human rabies deaths by mid-June 2010 and surely more to come. They may also approve the reduced intradermal postexposure vaccine prophylaxis schedule recommended by WHO for use on the island. It reduces the cost of imported tissue culture vaccines by up to 70% and has been used effectively and safely for many years by Thailand, Laos, Philippines, Sri Lanka and India as well as in some South American countries. Perhaps, the visitations of experts and the work shop that was conducted by the Thai team have not been entirely in vein. The availability of a complete postexposure management (WHO standard), using vaccine and immunoglobulin for severe exposures, presently virtually unavailable in Bali, also needs to be urgently addressed. Travelers exposed to rabies are currently being evacuated to Singapore or Australia. This causes delays and added risk of treatment failures as well as great expense. It has severely damaged the reputation of the tourist industry of Bali.

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Table 1. The Bali rabies outbreak human death list. Start November 2008 (first rabies outbreak in Bali after centuries). Updated at the end of March 2010.

No	Age	Date	Name	Regency	Result	Remark
1	46	9/17/08	Putu Linda	Badung/Unggasan	“suspect rabies”	Bitten by dog.
2	32	11/14/08	Made Artana	Badung/Unggasan	“suspect rabies”	Bitten by dog in September 2008.
3	3	11/21/08	Moch. Oktaf Rahmana	Badung/Unggasan	“suspect rabies”	Bitten by dog.
4	28	11/23/08	Ketut Made Wirata	Badung/Unggasan	Positive	Bitten by dog in September 2008.
5	3	12/30/08	Ketut Tangkas	Badung/Kutuh	“suspect rabies”	Was denied treatment--docs didn't believe he could have been exposed. Was bitten 6 months earlier & displayed all classic symptoms.
6	32	1/17/09	Thomas Aquino	Jimbaran	Positive	Was bitten in July 2008; came from Flores, as did the dog who bit him.
7	45	1/30/09	Ni Made Ruken	Nusa Dua	Positive	Bitten 3 months before death. Was taken to witch doctor.
8	46	3/23/09	I Wayan Nyoman Jama Asmara	Uluwatu		Bitten in November 2008.
9	24	3/28/09	Tukimah	Badung/Unggasan		
10	62	8/22/09	Nyoman Diatnya	Tabanan		Was grandfather of Ni father of Ni Made Dwi Kartika Ari. Both were bitten on July 23, 2009.
11	21	9/06/09	Ni Made Dwi Kartika Ari	Tabanan		Received VAR on 8/21 and 9/6.
12	47	9/14/09	Ni Ketut Sari	Tabanan		Bitten on 7/20/09. Was given tetanus shot but not VAR.
13	7	9/16/09	I.A. Pradnyaparamita	Tabanan	Name still not found in Dinas	Sought treatment, but local clinic was out of VAR.
14	78	9/22/09	Made Mastra	Tabanan		
15	6	10/9/09	Putu Dewanji Yogiswara	Tabanan	“suspect rabies”	
16	49	10/07/09	Ni Nyoman Sekarini	Tabanan		
17	54	10/08/09	Ni Wayan Marsi	Badung		
18	7	10/11/09	Diah Fitriani	Badung		
19	13	11/13/09	I Made Wiadi Astana	Denpasar		
20	12	11/23/09	Made Yuliarta	Karangasem	“suspect rabies”	Got bitten by a 1 month puppy, a pet belongs to him (I tried to find the exact age for the pup, but no success)
21	23	11/27/09	Nova Apandi	Tabanan	“suspect rabies”	Bitten in August 2009; did not seek treatment.
22	28	11/24/09	I Ketut Rawi	Karangasem		
23	4	12/05/09	Gusti Ngurah Sudiharta	Tabanan		Bitten in August 2009. VAR was unavailable in his area.
24	45	12/12/09	Ni Ketut Karni	Tabanan		Bitten in September 2009.
25	28	12/14/09	Putu Sudiarmika	Tabanan		Dogcatcher. Received VAR a week before death.
26	35	12/20/09	Komang Sri	Gianyar	“suspect rabies”	Got bitten 3,5 months ago, didn't get VAR
27	28	12/24/09	Yusuf Arimatias Sanam	Tabanan	“suspect rabies”	Got bitten by a dog three months ago and dog was taken to lab but resulted negative. Dog died 2 days later didn't get VAR
28	37	12/24/09	Herlin	Denpasar	“suspect rabies”	Got bitten by a dog six months ago and was taken to lab for test, confirmed positive rabies
29	46	12/11/09	Ketut Rawi	Karangasem	“suspect rabies”	Originally from Kangkahan, Abang in Karangasem. Date of death not specifically reported
30	64	12/29/09	Tjang Tjok Liam Kim	Karangasem		Got bitten on 7 December 2009 but was too late to get 3rd

Table 1. The Bali rabies outbreak human death list. Start November 2008 (first rabies outbreak in Bali after centuries). Updated at the end of March 2010.
(Continued)

No	Age	Date	Name	Regency	Result	Remark
31	65	9/1/2010	Wayan Lusir	Unggasan, Jimbaran	“suspect rabies”	VAR on the 28/12/09, local from jl. Bayangkara Amlapura Got bitten 6 months ago but never got any VAR. Died in Sanglah hospital
32	46	14/1/2010	Ni Nyoman Koming	Tabanan	“suspect rabies”	Got bitten 2 months ago which was confused by a story that she was bitten by a rat not a rabid dog
33	81	17/1/2010	Wayan	Kubu, Karangasem	“suspect rabies”	I Wayan is from Desa Ban, Kubu - Karangasem
34	11	18/1/2010	Kadek Ade	Kubu, Karangasem	Positive rabies result from lab?	
35	80	18/1/2010	I Wayan Lengit	Kubu, Karangasem	Positive rabies result from lab?	Got bitten by a dog about 2 months ago, she didn't get VAR
36	10	17/1/2010	Putri Sugianti	Tuban	“suspect rabies”	Got bitten by a dog 2 months ago but got VAR
37	60	15/2/2010	Ni Nengah Lempeh	Karangasem	Positive	Got bitten on the left leg and right arm never got VAR and bitten August 2008
38	5	21/2/2010	Kadek Aris Dwi Saputra	Bangli	Positive	Kadek got bitten by "an owned" rabid dog on his neck on 02/04/10 and got VAR 2 injections, 2 weeks later Friday 02/19/10 Aris suffered high fever. Dogs' owner is nowhere to be found
39	9	20/2/2010	Rai Arta Bawa	Tabanan	Positive	Was bitten on the face on Feb 9th 2010
40	36	8/3/2010	I Made Mawi	Mengwi	Positive	No history of dog bites, but his dog bit other person and was killed by villagers
41	45	9/3/2010	Ni Ketut Ardini	Tabanan	Positive	Got bitten by her own dog on the fingers 1,5 month ago "refused to go to hospital"
42	27	18/3/2010	Kadek Su	Peguyangan, Dps	“suspect rabies”	Not confirmed on history bites.
43	70	2/4/2010	Ni Wayan Srinting	Br. Bongan, Tabanan	Positive	Ni Wayan did not get VAR because the Sanglah hospital refuse to give to her.
44	43	3/5/2010	Ni Wayan Giatri	Karengasem		Death officially attributed to epilepsy; no known history of dog bite.
45	30	8/4/2010	Unnamed female	Tembuku, Bangli		Death officially attributed to meningitis.
46	40	30/4/2010	Ni Ketut Darti	Bebandum, Karengasem		Bitten 4 months before death, did not seek treatment.
47	40	30/4/2010	Ni Putu Sumantri	Kapal, Mengwi		VAR was unavailable in her region.
48	69	5/01/2010	Ni Ketut Tekasih	Abang, Karengasem		VAR was unavailable in her region.
49	30		Ni Nengah Rapi	Saren, Karengasem		Sought treatment, but local clinic was out of VAR.
50	22	5/5/2010	Ni Ketut Merta	Celagi, Karengasem		Bitten 2 months earlier; got VAR just two days before death.
51	42	11/5/2010	Nyoman Karmawan	Canggu, Badung		
52	50	13/5/2010	Nyoma Semadi	Kaliasem, Banjar		
53	13	16/5/2010	Ni Kadek Vina Kurniadewi	Buleleng		First known victim of cat bite. Bitten 3 months before death.
54	6	21/5/2010	Gede Agus	Gunung Sari, Buleleng		
55	4	25/5/2010	Putu Susila Ambara	Alasangker, Buleleng		Died 3 weeks after bite. Was not treated.
56	65	25/5/2010	Ni Nengah Suri	Uma Anyar, Buleleng		Died 2 months after bite. Did not seek treatment.

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