

CYSTICERCOSIS IN INDONESIA : EPIDEMIOLOGICAL ASPECTS

Sri S Margono¹, Rizal Subahar¹, Abdulbar Hamid², Toni Wandra³,
SS Raka Sudewi⁴, Putu Sutisna⁵ and Akira Ito⁶

¹Department of Parasitology and ²Department of Neurology, Faculty of Medicine, University of Indonesia;
³Directorate General Communicable Disease Control and Environmental Health, Ministry of Health and Welfare,
Jakarta, Indonesia; ⁴Department of Neurology and ⁵Department of Parasitology, Faculty of Medicine, Udayana
University, Indonesia; ⁶Department of Parasitology, Asahikawa Medical College, Asahikawa, Japan

Abstract. Cysticercosis caused by the larval stage, cysticercus or cysticerci, of the pork tapeworm *Taenia solium* was recognized at first in Bali and in Paniai District, Irian Jaya (Papua), Indonesia in the 1970s. In the 1990s a rapid increase in the number of the cases of epileptic seizures and burns in Jayawijaya district, eastern Papua, was observed. There were a total of 1,120 new cases of burns (7.0%) and 293 new cases of epileptic seizures (1.8%) from 15,939 local people during 1991-1995. Both histopathological examination and mitochondrial DNA analysis of resected cysts from patients and pigs revealed cysticerci of *T. solium*.

Antibody responses highly specific to cysticercosis were revealed in approximately 67% and 65% of persons respectively with epileptic seizures and with subcutaneous nodules. Therefore, most cases of epileptic seizures and burns were considered to be associated with cysticercosis in Papua. Additional serologically data from Bali showed that 13.5% of epileptic seizures (10/74) and 12.6% of asymptomatic individuals (94/746) were supposed having been exposed to *T. solium*. Histopathological evaluation of 80,000 tissue samples in East Java revealed that nine were cysticercosis. All cases were non-moslems and from two ethnic groups, Chinese and Balinese. Epidemiological data on cysticercosis are not available from other provinces of Indonesia, although cases of cysticercosis are occasionally reported. Therefore, other intensive epidemiological studies are strongly recommended, especially covering the eastern part of Indonesia.

INTRODUCTION

Cysticercosis caused by the larval stage of *Taenia solium* is an important parasitic zoonotic disease found in underdeveloped tropical areas including Indonesia. The transmission which is through eggs of the parasite, found on the soil, is due to promiscuous defecation and lack of sanitary facilities. Eating habits and unhygienic behavior are factors enhancing the degree of endemicity in an area. The most common clinical signs found in patients are subcutaneous nodules and epileptic seizures. Additional neurological symptoms such as headache, mental disorders, ophthalmological abnormalities are not unusual. In Indonesia, cysticercosis is a disease of non-moslem inhabitants mostly living in the eastern part of the country. Although it is known that in Indonesia the disease exist in several provinces, limited reports are available, especially on epidemiological aspects.

First cases on human cysticercosis were recorded by Bonne (1940), a case of a Chinese female from East Kalimantan, and another case by Hausman *et al* (1950). In Jakarta a case of cerebral cysticercosis was described by Lie *et al* (1955).

GEOGRAPHICAL DISTRIBUTION

Irian Jaya

The first thirteen cases suffering from epileptic

seizures were reported from the Paniai district in Irian Jaya. Stool examinations among 170 hospitalized patients revealed *Taenia* eggs in 9% of the samples (Tumada and Margono, 1973a, b). In 1978, Subianto *et al* described cases of burns as results of epileptic seizures. Before 1973 only a few cases of burns were admitted to the hospital of Enarotali, whereas during 1973 to 1976 the number of cases of burns increased to 257. In the age group of over 11 years burns were associated with suspected cysticercosis. Among 121 cases of the age group over 11 years, 88 cases suffered from epileptic seizures before or during hospitalization (62.8%). Subcutaneous nodules were found in 33.1% and 16.6% of the stool samples were positive for *Taenia* eggs or proglottids. In this area ELISA antibodies to cysticerci of *T. solium* were found in several population groups (Coker-Vann *et al*, 1981). The samples were collected from 31 symptomatic patients at the hospital and 120 samples from non-symptomatic general population of Obano village. In addition 345 samples were obtained from residents in the areas of Bilogai, Bilai and Tigiti, east of the Wissel Lakes (Paniai Lakes). From 6 other villages in the southern coastal lowlands among the Asmat and Citak communities and from 4 villages in the Eipomek valley of the central highland of the Mek group, 301 specimens were collected. Seropositive results were found in 61% of symptomatic cysticercosis patients, 16% in the endemic village of Obano, none in three villages adjacent to the endemic

area, whereas 2 individuals (1%) were positive in the distant Asmat group.

During the last years an increasing number of cases was found in Jayawijaya district, an area east of Paniai district. In 1994 and 1995, a total of 638 and 945 new cases respectively were reported from 20 local health units. The number of death due to the disease was 6 and 8 during the two years (Widarso *et al*, 1999). One of the local health unit was in Assologaima. An increasing number of seizures was recorded at this health unit (Wandra *et al*, 2000). In the year 1991 only 4 cases with seizures were reported among a population of 13,334, which meant an incidence rate of 0.03%. During the years 1992, 1993, 1994 and 1995 respectively 41, 68, 35 and 145 cases were recorded at the same health unit. The incidence rate of seizures during the four years were 0.28, 0.43, 0.21 and 0.83% respectively. The cysts, resected from 14 men and 1 pig, were diagnosed as cysticercus of *T. solium*. A questionnaire distributed to 30 respondents in Assologaima subdistrict revealed that 83.9% were analphabetic, 93.6% farmers and all of them sometimes ate pork, but no other meat. All of them roasted the meat on hot stones. The river was used as a source of drinking water by 93.3% and 90.3% admitted that they did not boil the water before drinking. Among them 64.5% did not wash their hands before eating and 58.1% after defecation. Of the respondents 64.5% defecated around bushes or in the forest. Widarso *et al* (2000) reported that none of them had toilet facilities, therefore probably the number of the respondents who were defecating promiscuously was much higher than admitted by themselves. It was also observed that pigs were roaming around houses, entering houses, although sometimes pigs were put behind fences.

Serological studies and DNA analysis has been conducted after international collaboration was established, especially with Department of Parasitology, Asahikawa Medical College. Serum samples were examined using antigens of *T. solium* cysticerci fractioned by single-step iso-electric focusing. Glycoprotein components of the antigens were highly specific and sensitive with immunoblot and ELISA technic for the diagnosis of cysticercosis (Ito *et al*, 1998).

Clinical symptoms were matched with seropositive results of 159 individuals from Wamena Kota and Assologaima and it was found that 84 persons among the group were positive, whereas 75 were negative. Suspected cases of cysticercosis, neurocysticercosis, mixed cases as well as many individuals in the group of population at risk were found serologically positive, which indicated the high endemicity of this disease in

Table 1
Clinical symptoms and seropositivity of 159 individuals in Wamena Kota and Assologaima, Irian Jaya (1999).

Subdistrict	Diagnosis	Immunoblot	
		Positive	Negative
Wamena Kota	Suspect CC	4	0
	Suspect NCC	9	0
	PAR	26	38
Assologaima	Suspect CC	4	3
	Suspect NCC	17	10
	Suspect NCC+CC	5	4
	PAR	19	20
Total		84	75

Notes: Data from International Study Group.

CC = subcutaneous cysticercosis;

NCC = neurocysticercosis; PAR = population at risk.

both sub districts (Table 1).

Data on distribution of cysticercosis in pigs are scarce and incomplete. Recently the Veterinary Unit of Jayawijaya district reported on 15 cyst positive pigs during August and September 1998. The pigs were from nine villages, 7 males and 8 females, age between 2-4 years (Table 2). Seventy-one serum samples from five villages were examined by immunoblot. Among these samples, 51 was positive (Tables 3, 4). A survey on pigs in 11 villages revealed seropositive samples in 17 (8.45%) among 201 samples. Five (6.17%) among the 81 male pigs and 12 (10.00%) among the 120 female pigs were seropositive; the age of the pigs were between 4-28 months (Subahar *et al*, 2000).

Bali

Besides *Taenia solium*, the classical *Taenia saginata* and *Taenia saginata asiatica* are found in Bali. Surveys on stool samples are not relevant for determining prevalences of taeniasis solium, because eggs recovered from stool samples are microscopically similar for the three cestodes.

It is known that Bali is an endemic area for cysticercosis / taeniasis, however reports are mostly on cases. Four cases, reported by Ngoerah (1975), were assumed to be suffering from neurocysticercosis. Signs of involvement of the central nervous system and cysts in muscles and subcutaneous tissues were found in these patients. Between the years 1991-1993 Sutisna (1993) reported 6 cases of cysticercosis. Five cases were males, whereas 1 case was a female; the

ages were between 12-39 years. One of the male patient suffered from multiple cysts with seizures and another male with multiple cysts, but did not suffer from seizures. In each of the other four cases only one single cyst was detected and these patients were without seizures. After CT scan was introduced in 1991 at a hospital in Denpasar, Bali more neurocysticercosis could be detected. During the years 1995-1997, 25 patients, 15 males and 10 females, aged between 23-65 years were treated for neurocysticercosis (Table 5). Among these patients 68% had epileptic seizures, 24%

suffered from cephalgia and 8% suffered from decreased consciousness, disorientation and a progressive decrease of memory. Most of the cases were of the age group between 61-65 years (20%). A biopsy on subcutaneous nodules of one of the patients revealed the cysticercus by histopathological examination. The CT-scan showed single or multiple nodular cystic lesions with or without contrast enhancement, low density lesions with ring enhancement and calcifications. Variation of clinical symptoms depended on size, number, type, location and stage of development of the cysts. Diagnosis was based on anamnesis, physical examinations and CT-scan (Raka Sudewi and Nuartha, 1998a, b).

Table 2
Fifteen cyst positive pigs reported by owners in Jayawijaya district during August and September 1998.

Case	Village	Sex	Age (Years)
1	Porome	M	4
2	Porome	M	3
3	Porome	M	4
4	Porome	M	2
5	Porome	M	2
6	Telunggame	F	3
7	Telunggame	F	3
8	Telunggame	M	2
9	Nunggar	F	3
10	Wolo	F	2
11	Dimba	M	2
12	Kurima	F	2
13	Tagime	F	2
14	Pindato	F	2
15	Ekapame	F	2

Data from The Veterinary Unit of Jayawijaya district (Rizal Subahar *et al*, 2000).

Theis *et al* (1994) collected samples from four different ecological regions in Bali and found an overall prevalence for anticysticercus antibodies of 13%. The nearly uniform distribution of seropositivity in the population, studied by age, gender, and geoclimatic zones, indicated that populations with high antibody levels to *T. solium* cysticerci occurred elsewhere in this province. Probably this was due to similar living conditions and behavior of the people throughout the whole island. Positive serological results of 10/74 (13.5%) among epileptic patients suggested that a significant number of these cases suffered from neurocysticercosis.

In a study on the detection of coproantigens in feces using the ELISA technic, Sutisna *et al* (1999) found 20 positive samples and after treatment with niclosamide 19 *T. saginata* and 1 *T. solium* worms were recovered.

In 1928, Le Coultre reported the findings of cysticerci in 1.8-3.2% pigs from Bali. A report from the Veterinary Unit, Denpasar for the years 1984-1988 mentioned that among 122,802, 157,585, 75,932,

Table 3
The result of immunoblot in pigs according to villages of Jayawijaya district, Irian Jaya in 1999.

No.	Village	Number of sera	Immunoblot			
			(-)	(+)	(++)	(+++)
1	Kim bim	27	5	10	2	10
2	Wesaput	24	7	7	4	6
3	Araboda	16	6	5	1	4
4	Piramid	3	1	1	0	1
5	Woma	1	1	0	0	0
Total		71	20	23	7	21

Notes: Data from International Study Group.

Table 4
Seropositive immunoblot against cysticercosis in pigs according to sex in 1999.

Sex	No.	Immunoblot				n(+) %
		(-) %	(+) %	(++) %	(+++) %	
Male	33	8 (24.2)	11 (33.3)	2 (6.1)	12 (36.4)	25 (75.8)
Female	38	12 (31.6)	12 (31.6)	3 (7.9)	11 (28.9)	26 (68.4)

Notes: Data from International Study Group.

Table 5
Patients with neurocysticercosis at Central General Hospital Denpasar, Bali, 1995-1997
according to sex and age groups (Raka Sudewi and Nuartha, 1998).

Age group (years)	Female		Male		Total	
	No.	%	No.	%	No.	%
20-25	1	4	3	12	4	16
26-30	3	12	1	4	4	16
31-35	-	-	2	8	2	8
36-40	1	4	-	-	1	4
41-45	1	4	3	12	4	16
46-50	1	4	-	-	1	4
51-55	1	4	2	8	3	12
56-60	-	-	1	4	1	4
61-65	2	8	3	12	5	20
Total	10	40	15	60	25	100

148,207 and 149,112 pigs during these five years 0.02%, 0.06%, 0.01%, 0% and 0% respectively were found positive for cysticercosis. Dharmawan *et al* (1992) found in 4,884 pigs from the slaughter house in Denpasar, Bali 7 positive cases (0.12%). Among the seven positive cases 4 were from the district of Karangasem, 2 from Gianyar and 1 from Badung. In this study they mentioned also that among 111 households 33 (29.7%) did not have sanitary facilities and 9 (8.1%) did not practise animal husbandry.

East Java

A histopathological study of 80,000 tissue specimens revealed 9 cases of cysticercosis, therefore the incidence rate was 0.011%. Three of these cases were described by Soebroto *et al* (1960) and Adnjana and Djojopranoto (1961), whereas the other cases were reported by Giri (1978). All cases were non-moslems and from two ethnic groups, Chinese and Balinese. This group consisted of five males and four females in

which the maximum age incidence (four cases) was noticed in the 21-30 year group. Multiple nodules were found in four cases and most of the cysts were found at the upper part of the body. In five cases, the cysts were imbedded in subcutaneous tissues, whereas in the other four cases, in the skeletal muscles. Radiological studies did not reveal any cyst in the brain.

Jakarta and other provinces

Cases were occasionally reported from Jakarta. Most of the cases were non-moslems, whereas the religion of some cases was not mentioned. A case of cerebral cysticercosis, a Chinese female, was diagnosed by Lie *et al* (1955). An operation revealed many cysts in the brain and the diagnosis was established by histopathological examinations. During the years 1962-1970, 7 persons suffering from taeniasis solium were found in Jakarta. One case was from Bali, 1 case from East Java, 2 cases from North Sumatra and 3 cases from Jakarta. Religion of the cases from

East Java and from Jakarta was not reported. The religion of the case from Bali was Hindu, whereas cases from North Sumatra were probably Christian (Hadidjaja, 1971). Multiple subcutaneous nodules, diagnosed as cysticerci, were found in another Chinese woman, 23 years of age. She also suffered from headache, nausea, parasthesia of the left face and had fainting spells (Hadidjaja *et al*, 1971). After this period, cases of cysticercosis were rarely documented in Jakarta.

CONCLUSION

In these reports it was shown distinctly that religion, way of life, socio-economic aspects were important aspects in perpetuating and enhancing the endemicity of cysticercosis, as well as taeniasis solium in several areas of Indonesia.

Studies, especially on epidemiological data of cysticercosis / taeniasis solium, are limited in Indonesia, therefore studies on epidemiological aspects are recommended, especially covering the eastern part of Indonesia and North Sumatra.

REFERENCES

- Adnjana IGNP, Djojopranoto M. Cysticercosis di bawah kulit pada manusia. *Madj Kedok Indon* 1961;11:188-9.
- Bonne C. De lintwormen van den mensch in Indie. Samenvattend overzicht. *Geneesk T Ned-Ind* 1940; 80:2376-84.
- Coker-Vann, Subianto DB, Brown P, *et al*. ELISA antibodies to cysticerci of *Taenia solium* in human populations in New Guinea, Oceania, and Southeast Asia. *Southeast Asian J Trop Med Public Health* 1981;12:499-505.
- Dharmawan NS, Siregar EAA, He S, *et al*. Cysticercosis pada babi di Bali. *Hemera Zoa* 1992;75:25-37.
- Giri IW. Cysticercosis in Surabaya, Indonesia. *Southeast Asian J Trop Med Public Health* 1978;9:232-6.
- Hadidjaja P. Beberapa kasus taeniasis di Djakarta. Tjara diagnosis dan pengobatan. *Madj Kedok Indon* 1971a;21:173-8.
- Hadidjaja P, Rukmono B, Sjamsuhidajat, *et al*. Another case of cysticercosis in Djakarta. *Madj Kedok Indon* 1971b; 21:461-4.
- Hausman R, Yoe TL, Fossen A. A case of cysticercosis, with some notes on taeniasis in Indonesia. *Doc Neerl Indones Morb Trop* 1950;2:59-61.
- Ito A, Plancarte A, Ma I, *et al*. Novel antigen for neurocysticercosis : Simple method for preparation and evaluation of serodiagnosis. *Am J Trop Med Hyg* 1998;59:291-4.
- Le Coultre AP. Cysticerci in het vleesch van rund en varken. Een hygienische studie, naar aanleiding van een bijzonder onderzoek naar deze parasieten op het eiland Bali. Utrecht 1928; Thesis 248p.
- Lie KJ, Gupito C, Handoyo K. A case of cysticercosis in Indonesia. *Doc Med Geogr Trop* 1955;2:134-5.
- Ngoerah IGNG. Cysticercosis dari susunan saraf pusat. *Maj Ilmiah Univ Udayana* 1975:31-8.
- Raka Sudewi AA, Nuartha AABN. Gambaran CT Sken beberapa kasus neurosistiserkosis di Rumah Sakit Umum Pusat Denpasar. Musyawarah Kerja dan Pertemuan Ilmiah Tahunan Perhimpunan Dokter Spesialis Saraf Indonesia (Working Conference and Yearly Scientific Meeting, Indonesian Neurologists Association), Malang, Indonesia, 1998a.
- Raka Sudewi AA, Nuartha AABN. Neurosistiserkosis di Rumah Sakit Umum Pusat Denpasar. Musyawarah Kerja dan Pertemuan Ilmiah Tahunan Perhimpunan Dokter Spesialis Saraf Indonesia (Working Conference and Yearly Scientific Meeting Indonesian Neurologists Association), Malang, Indonesia, 1998b.
- Rizal Subahar, Abdulbar Hamid, I Made Putra, *et al*. Cysticercosis seropositivity in pigs of Jayawijaya District, Irian Jaya, Indonesia. *Majalah Kesehatan Masyarakat Indonesia* 2000;28:344-6.
- Soebroto FX, Njoo TH, Djojonegoro M. Cysticercosis di bawah kulit pada manusia. *Maj Kedok Indon* 1960;10:460-2
- Sutisna P, Kapti IN, Ariwati L, *et al*. Deteksi coproantigen dengan teknik ELISA untuk diagnosis infeksi *Taenia* pada manusia. *Maj Kedokteran Udayana* 1999; 30:132-7.
- Sutisna P. Sistiserkosis di Bali: laporan 6 kasus. Seminar Parasitologi VII. Denpasar, Bali, 1993.
- Theis JH, Goldsmith RS, Flisser A, *et al*. Detection by immunoblot assay of antibodies to *Taenia solium* cysticerci in sera from residents of rural communities and from epileptic patients in Bali, Indonesia. *Southeast Asian J Trop Med Public Health* 1994;3:464-8.
- Tumada LR, Margono SS. Cysticercosis in the area of the Wissel Lakes, West Irian. *Southeast Asian J*

- Trop Med Public Health* 1973a;4:371-6.
- Tumada LR, Margono SS. Intestinal helminth infections in the Paniai Highlands, with special reference to *Taenia* and *Hymenolepis nana*. *Maj Kedok Indon* 1973b 22: 103-7.
- Veterinary Unit, Denpasar. Informasi data peternakan 1989: Report, 1989.
- Wandra T, Subahar R, Simanjuntak GM, *et al.* Resurgence of cases of epileptic seizures and burns associated with cysticercosis in Assologaima, Jayawijaya, Irian Jaya, Indonesia, 1991-95. *Trans R Soc Trop Med Hyg* 2000;94:46-50.
- Widarso, Purba WH, Wandra, *et al.* Permasalahan dalam program pemberantasan taeniasis/sistiserkosis di Indonesia Khususnya di Irian Jaya. Scientific Session at KONAS V PETRI, KONAS VIII P4I and KONAS PKWI, Makasar 1999.