

## TAENIASIS AND CYSTICERCOSIS IN THE PANIAI LAKES AREA OF IRIAN JAYA

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*Penyakit taeniasis dan cysticercosis diperkirakan baru masuk ke daerah Paniai dalam tahun 1970. Kasus-kasus pertama telah ditemukan dalam tahun 1971 diantara penderita yang dirawat di RSU Enarotali. Insidensnya terus meningkat sejak waktu itu dan dalam tahun 1975 sejumlah 60-100 penderita dilaporkan setiap bulan dari poliklinik RSU Enarotali. Survey yang diadakan dalam tahun 1973 di kampung-kampung sekitar Enarotali menemukan prevalensi 8 persen taeniasis dan 4,25 persen untuk cysticercosis. Survey ulangan dalam tahun 1975 menemukan suatu prevalensi sebesar 8,2 persen untuk cysticercosis, dan 3,5 persen epilepsi. Meningkatnya jumlah penderita epilepsi di daerah ini kemungkinan besar disebabkan cysticercosis cerebral. Meningkatnya jumlah penderita luka bakar juga berhubungan dengan epilepsi akibat cysticercosis ini.*

*Usaha-usaha untuk memberantas penyakit ini melalui penyuluhan kesehatan, pembangunan jamban keluarga dan pengawasan pemotongan babi sangat sukar dijalankan karena hambatan-hambatan di bidang sosial budaya. Penyakit ini pada babi telah menjalar ke daerah-daerah lain di pegunungan dan menimbulkan ketegangan-ketegangan sosial.*

*Penelitian lebih lanjut amat dibutuhkan, supaya suatu program pemberantasan yang lebih efektif dapat segera dilaksanakan untuk melindungi penduduk daerah Paniai dan daerah lainnya terhadap penyakit yang cukup berbahaya ini.*

Taeniasis solium is a disease caused by the presence of adult *Taenia solium* in the intestine and cysticercosis is caused by the larval forms of *Taenia solium* in the tissues. While taeniasis is a chronic non-fatal disease, cysticercosis is a disease of relatively high fatality if the central nervous system or internal organs are involved.

The sources of infection for taeniasis is the flesh of infected pigs, while for cysticercosis it is the eggs in faeces of an infected person. Cysticercosis may also result from regurgitation of eggs into the stomach of persons harbouring the adult worm.

Only a few reports are known about taeniasis solium and cysticercosis in Indonesia. Cases of taeniasis solium have been reported by Bonne (1940), Soebroto et al., (1960) and Hadidjaja (1971), while cysticercosis have been reported by Hausman et al., (1950), Lie Kian Joe et al., (1955), Soebroto et al. (1960), Adnjana and Djojopranoto (1961) and Hadidjaja et al., (1971). From those reports we get the impression that the disease occurs only sporadically in Jawa, Bali and Sumatera. The disease has never been reported from Papua New Guinea.

The only report about tape worm infection in Irian Jaya before 1972 was a case of *Hymenolepis nana* in Manokwari, on the north coast of the Vogelkop area (Kleevens and de Haas 1958).

It is therefore of considerable interest that in 1972 an important focus of taeniasis and cysticercosis was discovered in the Paniai Lakes area of the central highlands in Irian Jaya (Tumada and Margono, 1973).

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The purpose of this paper is to review and analyse the available data on taeniasis and cysticercosis in that area and discuss some aspect of its control.

**DESCRIPTION OF THE AREA**

The Paniai Lakes, formerly known as the Wissel Lakes, consist of three lakes: Paniai, Tage area lives in the Western part of the Central highlands at an altitude of 1400 to 1800 meters, and is composed of rugged mountain chains and deep valleys. Tropical rain forest covers the mountain slopes to an elevation of 2000 meters. Above the 2000 meter level one enters the zone of the moss forest. The floors of the deep valleys are, as a rule, swampy and covered with grass, fern, and reed growth. The secondary forests, a by product of the native shifting agricultural practices, are composed of several varieties of

willow-like trees, and of dense vine and grassy undergrowth.

The fauna is characterized by an almost complete absence of placental mammals. Except for a few species of rats and batas and a wild pig, the area's animal life consists of several types of marsupials, lizards, amphibians, and a great variety of insects and birds.

The climate is cool and wet, with no clear distinction between a dry and rainy season. The average yearly rainfall is about 3000 mm. The area is inhabited by the Ekagi or Kepauku tribe consisting of ± 100,000 people.

The name Kepauku has been given by people from the South coast, while the name Ekagi has been given by the Moni tribe which live north-east of the Paniai area. The Ekagi or Kepauku refer to themselves as Me, which means "the people".

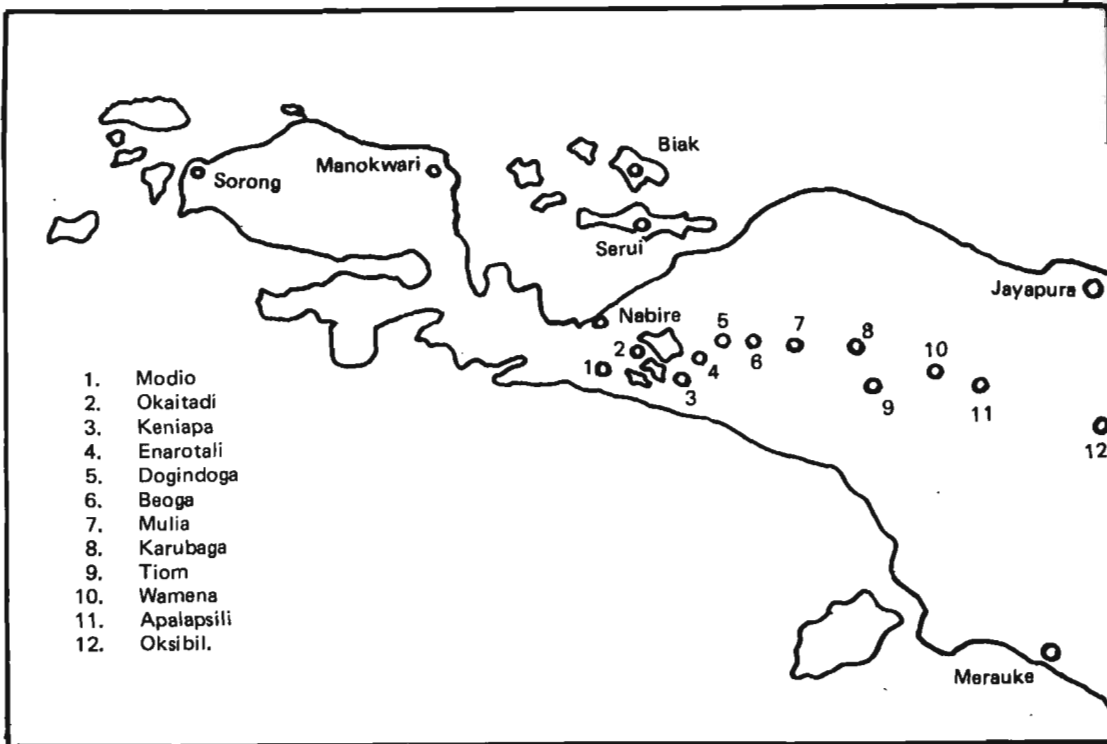


Figure 1. Map of Irian Jaya showing locations of pig cysticercosis in the highlands.

Isolated from the outside world by high mountain ranges and extensive swamps and tropical rain forests, the Ekagi led their traditional lives undisturbed until 1938, when a small government post was started at Anarotali. However, this contact was short lived because the post had to be abandoned during the Second World War. A new government post was established in 1946 and was later joined by Catholic and Protestant missionaries who began to work among the people. The Ekagi actually belong missionaries who began to the first people of the central highlands who came in contact with the government and missions. At present most of the people have been christianized, but tribal religious beliefs and practices still play a very important role in their lives.

The staple food is the sweet potato, the cultivation of which is mainly the responsibility of women.

Animal protein is very scarce. It is obtained mainly from catching small animals and fish, and rarely (maybe once a month) from the slaughter of pigs.

Beetle nut (which has some taenicidal properties) is not consumed by people from the central highlands (beetle nut chewing is a frequent practice among the coastal people of Irian Jaya).

In spite of the rather low temperature, clothes are almost unknown.

Traditionally the men only wear a penis gourd or koteka and the women a small skirt made from strands of bark. Most of the people still live in their traditional houses, in which most of the day and all during the night open fires for warmth burn in every room.

Hygienic standards are very low and the use of latrines has not yet become a habit until very recently.

Main diseases are malnutrition, skin diseases (including yaws), respiratory infection, diarrhoea and intestinal parasitic infestations.

Malaria transmission occurs only in the lower lying valleys. Leprosy has never been found, but tuberculosis has recently been introduced by local people who have spent some in the coastal towns.

## TAENIASIS

An investigation in 1957 by Van der Hoeven and Rijpstra showed a high incidence of intestinal parasites: hookworm, ascaris, trichuris, and *Balantidium coli* but no tape worms.

In 1972, eggs and proglottids of *Taenia solium* could be found not too rarely in routine stool examinations of patients treated in Enarotali hospital. This led to further investigations. Fecal samples of 170 hospitalized patients were examined and taenia eggs or proglottids were found in 9 per cent the samples. The frequency among 74 out patients was 8 per cent

Another interesting finding was the identification of *Hymenolepid nana* in 8 per cent of the samples from the hospital as well as the outpatient clinic.

An investigation in the Dogindoga area, northeast of Enarotali and inhabited by the Moni tribe did not reveal any tape worm infection among the 78 samples examined.

Table 1 Intestinal helminths in people from Paniai

Helminth	Enarotali 170 inpatients	Enarotali 74 outpatients	Modio 82 persons	Dogindoga 78 persons
<i>A. Lumbricoides</i>	58	69	80	73
Hookworm	58	61	75	64
<i>T. Trichiura</i>	55	47	10	69
<i>O. Vermicularis</i>	1	1	1	9
<i>Hymenolepis nana</i>	8	8	—	—
<i>Taenia solium</i>	9	8	—	—

A stool survey among the general population of Modio, in the Mapia valley, south-east from Enarotali, carried out in 1975 did not reveal any tape worm infection. The people from Modio belong to the Ekagi tribe but have characteristics in their culture which differs from the Lakes area.

Cysticercosis nodules in slaughtered pigs have frequently been observed since 1971. *Cysticercus cellulosae* had been identified in pork sent to the Institute for Veterinary Pathology in Bogor. No information is available on the prevalence of cysticercosis among the pigs, but there are unconfirmed reports that this had been observed in Modio, Dogindoga, Beoga, Mulia, Karubaga, Tiom, Hetigima, Wamena, Apalapsili and Oksibil (near the border with Papua New Guinea). Human cases of taeniasis or cysticercosis in those places have not yet been discovered, but this may change if surveys and better surveillance activities are undertaken.

**CYSTICERCOSIS**

The first 13 cases of human cysticercosis discovered in Enarotali hospital during a period of 6 months (October 1972 - March 1973) were described by Tumada and Sri Margono. Biopsies were sent to the Institute of Parasitology of the University of Indonesia in Jakarta, which confirmed the diagnosis of cysticercosis. Table 2.

Seven of the 13 patients had epileptic seizures, suggestive of cerebral localisation, and 6 had eye complaints suggestive of ocular location of cysticerci. As can be seen in table

Table 2 Symptoms of 13 cysticercosis patients treated in Enarotali Hospital.

Symptoms	Number of patients
Headache/dizziness	9
Epileptic seizures	7
Personality changes/odd behavior	2
Eye complaints (blurring, diplopia)	6
Lethargy/apathy	2
Abdominal/epigastric pain	5
Burns	2

Table 3 Localisation of palpable cysticercosis nodules in 13 patients.

Localisation	Number of cases
Biceps muscle	9
Forearm	7
Pectoralis	5
Deltoid	4
Neck	4
Abdominal wall	3
Near the mount	1

3. most of the nodules are located on the upper parts of the body.

Laboratory examinations reveal normal hemoglobin values, leucocytosis in 60 per cent and eosinophilia in 35 per cent of the cysticercosis patients. About 45 per cent had *Taenia solium* eggs or proglottids in their stools. They may have got the cysticercosis by auto-infection or regurgitation of eggs.

The 13 cysticercosis patients consisted of 8 men and 5 women with an age range of 16 to 40 years.

Hetrazan (diethyl carbamazine) was used in an attempt to treat the cysticercosis in 10 patients. A ten day course of 200 mg Hetrazan daily was given. This was repeated in 8 of the 10 patients. An antihistaminic drug (Incidal) was given in addition to prevent side effects of hetrazan, such as nausea and vomiting. Improvement was observed in 7 of the patients and no clear side effects were found. Callais et al (1955) also reported considerable improvement in 2 patients from cerebral cysticercosis after treatment with hetrazan in combination with phenegan.

A survey of ± 2000 people in Keniapa and Okaitadi, villages around Enarotali in 1974, revealed that 4,25 per cent of the people had palpable cysticercosis. No cysticercosis was found in children younger than 12 years.

A resurvey carried out one year later gave a prevalence of 9,1 per cent. It was also found that among the 850 people examined, 30 were epileptics, which gives an epilepsy prevalence of 3.5 per cent. This is strongly suggestive of cerebral cysticercosis, because most of the cases started to have first one to two years before

In 1975, 60 - 100 cysticercosis patients are seen monthly in the outpatient department of Enarotali hospital.

### AN "EPIDEMIC" OF BURNS

As most of the people sleep beside open fires to fight the cold, accidental burns are not uncommon, especially among infants and small children. In the period 1968 - 1971 only 5 to 8 burn cases were admitted annually to Enarotali hospital.

The number of burn cases admitted to the

hospital started to rise in 1972 (28 cases). In 1973 it rose to 43 cases and in 1974 to 42 cases. Interestingly many of these burn patients had also epileptic fits before or during hospitalisation.

Analysis of the records of all burn patients admitted to Enarotali hospital in 1973 - 1974 reveal the following findings:

The highest incidence was among the 21 - 40 year age group and there was a clear preponderance of males, the male to female ratio being 3 : 1., and The age and sex distribution: can be seen in Fig. II.

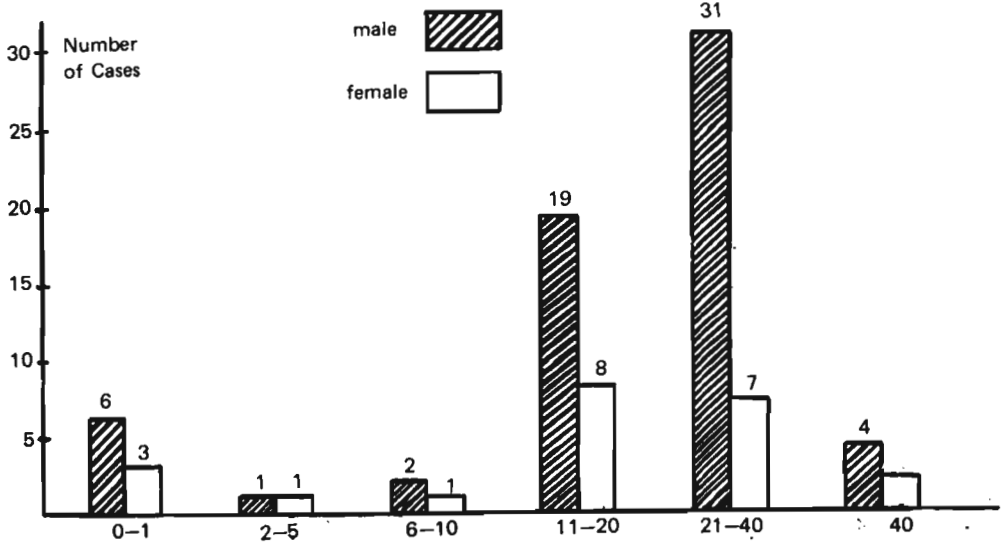


Figure II Age and sex distribution of 85 burn patients admitted to Enarotali hospital in 1973-1974.

The high incidence of severe burns (83,7 per cent were third or fourth degree burns). the fact that 66,3 per cent of the patients were still unconscious when helped out of the fire, the high incidence of palpable cysticercosis (32,4 per cent compared with 9,1 per cent in the general population), the high incidence of intestinal taeniasis (27,3 per cent compared with 8 per cent among the general population) and the high incidence of epilepsi (58,1 per cent compared with 3,5 per cent in the general population), all support the sus-

picion that cerebral cysticercosis is responsible for the increase in burn cases.

Several deaths due to epileptic fits or severe burns have occurred in the villages, but could not be verified. Five deaths of burn patients have occurred in the hospital, but unfortunately autopsy could not be done.

The cause of death was tetanus (2 cases), sepsis, status epilepticus and anaesthesia (during amputation).

The average length of hospitalisation of the burn patients was  $\pm 60$  days and most of

Table 4. Signs and symptoms of burn patients admitted to Enarotali Hospital in 1973-1974.

Signs & Symptoms	M a l e				F e m a l e			Total Female	Total Male & Fem
	0-1 year	2-10 year	10 year	Total Male	0-1 year	2-10 year	10 year		
Still unconscious when helped out of fire	0	1	42	43	0	0	14	14	57 (66.3)
Aware when burned or heard cried	3	2	2	7	3	1	1	5	12 (13.9)
Epileptic fits	0	0	33	33	0	0	10	10	43 (58.1)
With taeniasis	0	1	15	16	0	0	4	4	20 (27.3)
With palpable Cysticercosis	0	0	20	20	0	0	4	4	24 (32.4)

them required skin grafting or reconstructive surgery. The signs and symptoms according to age and sex can be seen in Table 4.

Ten had to undergo amputation of an extremity. Most of the patients who recovered became invalids who are unable to do their daily work properly, and so became a burden for the community.

### Control measures

Control measures were taken by the local health service in co-operation with the religious missions since 1972. These consisted of:

Health education and introduction of latrines, attempts at meat inspection, treatment of taeniasis with atabrine, prohibition to transport pigs from the Paniai area.

**Health education:** was undertaken with special emphasis on: explanation on the life cycle of *Taenia solium*, the construction and use of latrines, through cooking of pork, avoidance of consumption of infected meat, better personal hygiene, burn prevention (construction of fence around house fires).

For these purposes, mimeographed pictures and slides have been prepared and short courses have been organized for school teachers, bible teachers and health personnel in this area. It is expected that these persons, who all speak the Ekagi language, will teach the people in the villages.

Inspection of villages where some health education activities have been undertaken, showed that 30 to 70 per cent of the houses

had already latrines.

Nails have been distributed to the people through the "Inpres" programme to assist construction of latrines. It was observed the latrines were not used regularly. People used it when they are near the latrine but not if they are working in the gardens.

Adequate cooking of pork is very difficult because the people do not have any kitchen wares. Cooking pots which have been distributed by the Catholic mission were mostly used to transport and store water.

**Some meat inspection:** could be done during "yuwe" or pig feasts, when tens or hundreds of pigs are slaughtered. This was carried by the local health auxiliary with the assistance of school and bible teachers as there were no veterinary personnel working in the area. People were requested to discard or burn infected pigs, but this was not always successful. Incidental slaughtering of pigs in villages could not be inspected, as this was often done in secrecy during the night.

Standard treatment for taeniasis were as follows: 30 grammes of Magnesium sulfate in the evening as a purge, the following morning a total dose of 800 mg Atabrine (quinacrine hydrochloride) was given in an empty stomach as follows: 200 mg every 15 minutes in combination with 500 mg Sodium bicarbonate, two hours later another 30 grammes of Magnesium sulfate was given.

In 85 per cent of the cases, this treatment was successful, resulting in the expulsion of the whole worm.

Atrabine was used because it was the only taenicidal drug available at that time. It has the advantage that it does not destroy the segments of the worm, thus reducing the risk of cysticercosis caused by regurgitation of liberated eggs.

Sodium bicarbonate was given to reduce gastric irritation.

Atebrine is at present not available in Indonesia and up till now we have not succeeded to obtain an adequate supply of the drug. Niclosamide or Yomesan, another drug recommended for the treatment of taeniasis, is also not marketed in Indonesia.

Pits of the red pumpkin (semen cucurbitae) are used traditionally else where in Indonesia (e.g. in Bali) for the treatment of taeniasis.

Efforts are being made to obtain the seeds and introduce the plant in the Paniai area.

Another possibility is to introduce the beetle nut which is known to have taenicidal properties. Beetle nut chewing is extensively practiced in the coastal areas of Irian Jaya and there taeniasis has never been discovered. Epileptic first can be controlled by barbiturates.

**Prohibition to export pigs** from the Paniai regency is based on a decree of the local Representative Council. Pigs are traded extensively between the tribes and villages and there are no means to control this traditional trade activities in the highlands.

## SOCIO-CULTURAL ASPECTS

It is clear from the above, that the efforts control the disease were not very successful. The incidence of the disease is increasing in the Paniai area and it is spread into the other areas in the highlands, at least among the pigs. Many Ekagis are to be found in the other areas as school teachers, bible teachers, government and local traders.

They may have been spreading the disease and human cases may be found if surveys and better surveillance are carried out.

The control of the disease in the Paniai area is particularly difficult because of the socio-cultural context in which it is em-

bedded. Dr Pospisil, an anthropologist who has made a special study of the Ekagi tribe, described the main characteristics of the culture as individualism, secularism, wealth and profit orientation and a quantitative world view.

The members of the King Leopold expedition, who visited the area in 1973, spoke of the people as "primitive capitalists".

Father Hylkema, a Catholic missionary who is studying the culture of the Ekagi tribe in Uwebutu at the Tage Lake, described the typical Ekagi as an individualistic, materialistic and avaricious person (personal communication).

Discarding pig meat, even if infected with cysticerci, does not fit with their materialistic and avaricious nature.

Slaughtering pigs are very often done after dark in the presence of a limited and trusted audience. This is caused by the fear that if the pig is killed during day time, other people will also ask for the meat.

This haste and secrecy in the slaughtering and consumption also contribute to the spread of taeniasis.

Another aspect is the phenomenon of "demasculinisation". Before the government and missions got a stronghold in this area, the preparation and conduct of wars were most important functions of the men. This and many other important tribal functions of the men feel that they have lost their function and manliness. The superiority of new norms and morality imposed by the government and missions are not always clear for the people. It must be admitted that contact with newcomers was not always beneficial for the people. Dissatisfaction and frustration make the men do all the wrong things.

To reestablish their dignity and manliness they disregard the advice given by government and mission personnel.

Another socio-cultural aspect is the fatalism of the people.

After discovering that a slaughtered pig was infected, one village headman stated: "If we eat this meat we will die and if we do not eat

this meat we will also die. What is the meaning of death? In the future we all will die. So let us eat this delicious meat!" (Father Hylkema, personal communication). Actually, this way of thinking is not peculiar to the Ekagi people. Many modern and educated people have the same way of thinking, e.g. with regard to cigarette smoking.

Some of the village headmen blamed the newcomers from outside as the ones who brought the disease to the Paniai area. Others suspected that the disease was introduced through pigs bought in from the other island. Another opinion was that the disease has been introduced as a punishment for the death of several soldiers in the 1969 uprising. It should be noted that there was an up rising against the government and missions in 1956, in which the introduction of pertussis was one of the precipitating factors (V. Nunen, 1957).

The spread of the disease among pigs to other areas in the highlands, had also created some social unrest among the other tribes.

The advice given to destroy/not to consume infected pigs were mostly followed and no human cases of taeniasis or cyticercosis have been discovered outside the Paniai area. There is a possibility that the introduction of human cysticercosis will result in violence against the Ekagi people in those areas.

## SUMMARY AND CONCLUSIONS

The available data from reports, records, publications, personal communications and observations about taeniasis and cysticercosis and the attempts to control the disease have been reviewed and analysed.

The disease mut have been introduced into the area around 1970.

The first cases of taeniasis were discovered in late 1971 and the first cases of cysticercosis in late 1972 among patients admitted to Enarotali hospital. The incidence had been increasing since that time and in 1975, 60-100

patients suffering from taeniasis or cysticercosis are seen monthly in the outpatient department of the hospital.

Surveys in 1973 revealed a prevalence of per cent for taeniasis and 4,25 per cent of palpable cysticercosis among the population Enarotali and the surrounding villages. A survey in early 1975 showed an increase the prevalence of palpable cysticercosis to 8 per cent, while the prevalence of epilepsy was 3,5 per cent.

The increase of epilepsy cases since the last two years is strongly suggestive of cerebral cysticercosis. The increase of burn cases admitted to Enarotali hospital is related to epilepsy and cerebral cysticercosis. The disease still increasing in the Paniai Lakes area and is spreading among the pigs to the other areas of the highlands. It has created much social unrest in the Paniai area as well as in the other areas of the highlands.

The attempts to control the disease through health education, introduction of latrines, meat inspection and prohibition of transport pigs from the Paniai area were very successful so far. The control of the disease is particularly challenging because of the cross-cultural context in which it is embedded.

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## REFERENCES

- Adjana, I.G.N.P. and Djojopranoto, M. (1961) Cysticercosis di bawah kulit pada manusia. *Majalah Kgdokt. Indon. (J. Indon. Med. Ass.)* 11 : 188-189
- Black, R.H. (1966) Differential Distribution of Disease between Indonesia and Papua New Guinea: Health Dangers of the Common Border. *Papua New Guinea Med. J.* 9 : 3-10
- Bonne, C. (1940) De lintwormen van de mensch in Indie, *Geneesk. Tijdsch.v. Ned. Ind* 80 : 2376-2384
- Callais, P., Ruzie, J. and Darcourt (1955) Lacysticercose cerebral. Consideration cliniques actualles. *Arch. med. Gem. Trop.* 32 : 83 ( Abstracted in *Trop. dis. Bull.*, 1957, 54 : 982)
- Hadidjaja, P. (1971) Beberapa kasus taeniasis di Jakarta: cara diagnosa dan pengobatan. *Maj. Kedokt. Indon. (J. Indon. Med. Ass.)* 21 : 173-178
- Hadidjaja, P., Rukmono, B., Sjansuhidajat and Himawan, S. (1971) Another case of cysticercosis in Jakarta. *Maj. Kedokt. Indon. (J. Indon. Med. Ass.)* 21 : 461-463
- Hausman, R. You Tjin Liong and Fossen, A (1950) Een geval van cysticercose met enkele aantkeningen, over taeniasis in Indonesia. *Doc. Neerl. Indon. Morb. Trop.* 2 : 59
- Hoeven, J.A. van der and Rijpstra. A.C. (1957) intestinal parasites in the Central Mountain District of Netherlands New Guinea. An important focus of *Balantidium coli*. *Doc. Med. Geogr. Trop.* 9 : 225 : 228
- Hunter, G.W., Frye, W.W. and Schwartzwelder, J.C. (1967) A manual of tropical medicine, Fourth edition, W.B. Saunders Comp. Philadelphia & London
- Kleevens, J.W.L. and Has, R.A. de (1959) A case of *Hymenolepis nana* in Netherlands New Guinea: *doc. Med. Geogr. Trop.* 9 : 225-228
- Lie Kian Joe, Gupito, Ch and Handojo. K. (1955) A case of cysticercosis in Indonesia. *Doc. Med. Geogr. Trop.* 2 : 134
- Maegraith, B.G. (1971) *Adams & Maegraith Clinical Tropical Diseases*, Fifth edition, ELBS and Blackwell Scientific Publications, Oxford and Edinburgh
- Nunen, B.O. (1957) Nota omtrent de Obano Opstand Nov.-Dec. 1956. Unpublished document. Keuskupan Jayapura
- Pospisil, L. (1963) The Kepauku Papuans of West New Guinea. Holt. Rinchart and Winston, New York
- Soebroto, F.X., Njoo Tjing Hwa dan Djojopranoto, M. (1960) Cysticercosis di bawah kulit pada manusia. *Maj. Kedokt. Indon. (J. Indon. Med. Ass.)* 10 : 460
- Tumada, L.R. and Margono, Sri S. (1973) Intestinal helminthic infection in the Paniai Highlands, with special reference to *Taenia* and *Hymenolepis nana*. *Maj. Kedokt. Indon. (J. Indon. Med. Ass.)* 22 : 103-107