

Taeniasis and neurocysticercosis among Malaysians

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Abstract. Taeniasis, endemic in Southeast Asia, is caused by *Taenia saginata* (for beef) or *Taenia solium* and *Taenia asiatica* (for pork). *T. solium* also causes cysticercosis which can affect various organs. Taeniasis and cysticercosis cases are rarely reported in Malaysia. We report here two separate cases of beef taeniasis, and an interesting case of neurocysticercosis in a Malay Muslim. The taeniasis cases involved a Malaysian Chinese and a native Sabahan. Proglottids were recovered from them, and identification of the tapeworm done either from the microscopic examination of the egg or using PCR-based molecular diagnosis. Upon confirmation of taeniasis, both cases were given praziquantel and had been asymptomatic since. The neurocysticercosis case involving a Muslim who presented with seizure, was confirmed by histopathological examination of tissue sections taken from craniotomy excision of the brain lesion. He was given one month course of albendazole 400 mg bid and dexamethasone, and had been well and seizure free since. The two cases of taeniasis documented here had acquired the disease through eating raw or undercooked contaminated beef. For the neurocysticercosis case, it is suspected that he might have acquired the infection in one of his travels through human to human transmission via contaminated food or water consumption, given that Malaysia is not *T. solium* endemic area. Lastly praziquantel is an effective drug for beef taeniasis, while a combination of albendazole and dexamethasone work well for neurocysticercosis.

INTRODUCTION

In Asia, taeniasis caused by *Taenia saginata*, *T. solium* or *T. asiatica* has been reported in Indonesia (Wandra *et al.*, 2013), the Philippines (Cabrera, 1973), Vietnam (Somers *et al.*, 2007), China (Xiaopeng, 1991), Taiwan (Chen, 1991), Korea (Cho *et al.*, 2014) and India (Ahmed *et al.*, 1988). In most cases, the symptoms such as abdominal pain or discomfort are usually very minimal, and the infected person may not be aware of it.

Taenia solium infection can also lead to cysticercosis and neurocysticercosis. The

latter can cause seizures, can be life-threatening and has been reported to be a serious threat to economic productivity and human health in many areas of the Southeast Asia region (Rajshekhar *et al.*, 2003, Ito *et al.*, 2004, Wandra *et al.*, 2006 and Wandra *et al.*, 2007). The conventional diagnosis of neurocysticercosis requires a compatible clinical history, positive serology, and neuro-imaging features (Del Brutto *et al.*, 2015).

Taeniasis and cysticercosis cases are rarely reported in Malaysia. In 1973, taeniasis by *T. saginata* was first recorded among local Malays in Perlis (Teoh, 1976). Since then, there has been no other report. As for

cysticercosis, there are a few case reports from Malaysia in recent years (Chew *et al.*, 2001, Ibrahim *et al.*, 2003, Arasu *et al.*, 2005, Nor Zainura *et al.*, 2005, Hasan *et al.*, 2011). The latest confirmed neurocysticercosis cases was in a pediatric case who presented with seizure and underwent surgical excision of the live larva from the brain (Hasan *et al.*, 2011).

In this paper, we highlight two cases of beef taeniasis which occurred in a Malaysian Chinese and a native Sabahan, and a case of neurocysticercosis in a Malay Muslim. These three cases were reported from three different states in Malaysia occurring within a span of two years. The aim of compiling these cases together is to highlight the different transmission routes of *Taenia* sp. infections to humans and to correct the misconception of the public regarding the transmission route of neurocysticercosis.

Case 1

This case was a 23-year-old Chinese Malaysian who acquired the infection during his three-week visit (August – September 2012) to Madagascar. During his stay there, he had consumed lots of half and undercooked beef. He claimed to have expelled “worms” (actually proglottids) in his stools for 2/52. He self-medicated by taking 3 doses of albendazole 400mg in 10 days based on his online search. Since the passing out of proglottids in his stool persisted, he sought treatment at a private clinic and was given 3 tablets of ivermectin. He came to the hospital on January 18, 2013 and brought along a proglottid of a worm. His full blood count was haemoglobin (Hb) of 13.9g/dl, total white cell count (TWC) of $5.7 \times 10^3/\text{microL}$ with eosinophil count of 0.3 (5.2%) and platelet count of $275 \times 10^3/\text{microL}$. The following day, he brought a longer whitish section of a worm specimen together with his stool (Figure 1). From the size of the gravid proglottid, the species was identified as *Taenia saginata*. *Taenia* eggs recovered from the gravid proglottid measured 20–40 μm and had six hooked larva (oncosphere) enclosed in a thick dark brown radially striated shell (Figure 2). The patient’s father who was residing in

Madagascar was asymptomatic whilst the patient’s mother who did not travel to Madagascar, did not show any symptoms. The patient received 600 mg Praziquantel and had been asymptomatic since then.

Case 2

Taeniasis was observed in a 56-year-old male native Dusun Sabahan who was a veterinarian assistant from Kota Belud. His job scope included examining cow dung daily for worms and rectal palpation for pregnancy diagnosis. He had developed a habit of consuming raw beef, the timing of which preceded the onset of his symptoms. He presented in June 2014 with complaints of abdominal discomfort, loss of appetite and weight. For the past 6 years, he had intermittently passing loose stools which contained “worms”. His stool was greyish, mixed with mucus. He lost a total of 6 kg over 3 years. Between June 2008 and December 2013, he was given a total of 13 courses of albendazole from various general practitioners, which provided only a brief respite for his symptoms each time. He was subsequently referred to Gastroenterology Department in June 2014. On examination,



Figure 1. The proglottids of the adult *Taenia*.



Figure 2. A *Taenia* sp. egg with hexacanth embryo which has 6 hooks (4 are distinctively visible) surrounded with a thick radially striated brown shell retrieved from patient's stool.

his vitals were stable (pulse 76/ min; blood pressure 124/78 mmHg) and he was afebrile. His blood serum biochemical and hematological parameters were within the normal range. Oesophagogastroduodenoscopy (OGDS) and colonoscopy performed revealed pangastritis, an adenomatous rectal polyp respectively, but no intestinal worms. However, a few gravid proglottids, measuring an average of 1.5 × 0.5 cm each, were recovered from his stool sample and one of which was subjected to PCR-based molecular identification confirming it to be *Taenia saginata*.

Briefly, the primers used for the amplification and sequencing of the second internal transcribed spacer (ITS2) region of ribosomal DNA were 3S: 5'-GGTACCGG TGGATCACTC GGCTCGTG-3' (forward) and A28: 5'-GGGATCCTGGTTAGTTTCTT TTCC TCCGC-3' (reverse) (manufactured by 1st BASE Laboratories Sdn Bhd) based on the conserved sequences of the 5.8S and 28S genes (Bowles *et al.*, 1995). The PCR amplification was performed using the following protocol with 2.0 ul of DNA template, 3.0 ul of 25mM MgCl₂, 0.5 ul of 10mM dNTPs mixture (Promega), 1.0 ul of 10 uM of each primer, 0.3 ul of Taq polymerase (5U/ul) (Promega), 12.2ul sterile dH₂O and 5X buffer (Promega) (total volume 25 ul). The

PCR cocktail was amplified with the following conditions: 94°C for 5 min, 35 cycles of denaturation at 94°C for 1 min, annealing at 55°C for 1 min and extension at 72°C for 1 min followed by a final extension at 72°C for 5 min, and cool down at 4°C for few minutes. The resultant PCR product was analyzed by gel electrophoresis and subsequently sent for DNA sequencing. The sequencing results of the 689 base pairs was then blasted on NCBI website with BLASTN 2.2.29, (<http://blast.ncbi.nlm.nih.gov/Blast.cgi>) for species identification, and was found to have 98% identity with *Taenia saginata*. The sequence has been deposited in the GenBank with the accession number BankIt1868533 CTH1 KU041644.

Upon confirmation of taeniasis, he was given praziquantel (400 mg stat dose) and had been asymptomatic since then.

Case 3

A 43-year-old, seemingly healthy Malay Muslim man presented with an episode of generalized tonic-clonic seizure on 23rd November 2014. There were no associated constitutional symptoms. He worked as a project director and travelled frequently, mostly to Southeast Asia and South Asia as per his job requirement. He was admitted to hospital and was found to have a partially

calcified enhancing lesion in the posterior occipital region with surrounding edema on MRI brain (Figure 3). CT-scan assessment of thorax and abdomen were unremarkable. He consulted a neurosurgeon at the hospital on 1st December 2014, and was advised to have stereotactic right craniotomy excision of the brain lesion. Frozen section showed granulomatous inflammatory mass with parasitic part (Figure 4–5). Further histo-

pathological examination showed changes in keeping with neurocysticercosis. Serological testing was not conducted as the kit was not available at the institution. After his pathological confirmation he was treated with a one month course of albendazole 400 mg bid and dexamethasone. He had been well and seizure free since. A repeat MRI brain on 7th January 2015 showed complete resolution of previous lesion.

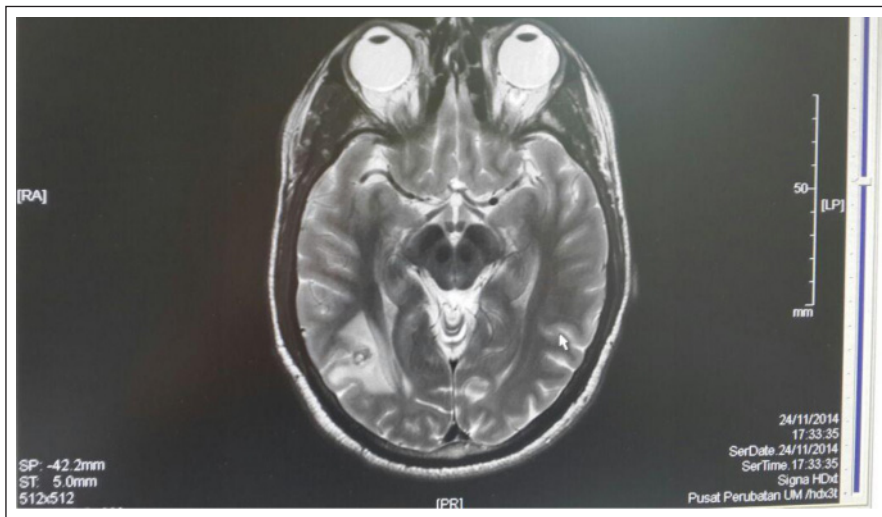


Figure 3. MRI brain indicating colloidal vesicular stage of the cyst, which is the first stage of involution of cysticerci. Cyst fluid is hyperattenuating to cranial spinal fluid (CSF).

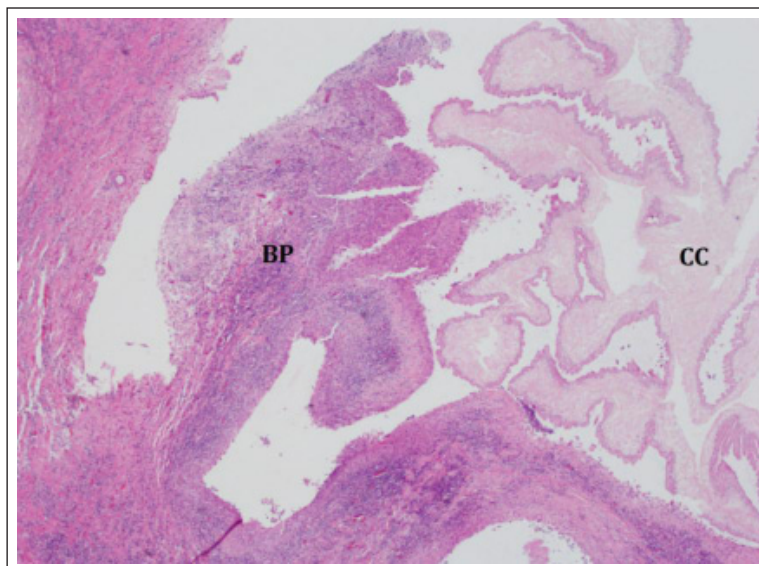


Figure 4. Larval *Taenia solium* cyst in a section of a lesion excised from the patient and stained with hematoxylin and eosin (H&E), magnification 4x. CC cyst of cystocercus; BP brain parenchyma.

DISCUSSION

In Malaysia, *saginata* taeniasis was first documented in 1973 (Teoh, 1976), involving three cases among local Malays in Perlis within a year. The cause of infection was determined to be the consumption of 'kerbau mentah' (raw buffalo meat smuggled from Southern Thailand), a local delicacy consisting of pickled raw or semi-cooked beef. In the present case of the native Sabahan, it is certain that the patient had taeniasis from eating raw beef containing the cysticerci. It is unlikely that this patient is the only case in Sabah as consuming raw or undercooked meat is quite common among the communities. The reason for under-reporting of taeniasis may be due to the usually mild or absence of taeniasis symptoms and patients may not be aware they have been infected with tapeworm.

Although there are more cases of neurocysticercosis than taeniasis being reported in Malaysia (Chew *et al.*, 2001, Ibrahim *et al.*, 2003, Arasu *et al.*, 2005, Nor Zainura *et al.*, 2005, Hasan *et al.*, 2011), the actual burden of taeniasis and cysticercosis is unstudied. This is because even if *Taenia* eggs were detected by microscopy, further analysis for species identification, especially by molecular methods, is not routinely done. As taeniasis cases are very rarely reported in Malaysia, many clinicians are not familiar with both this infection and the availability of molecular diagnostic facility in the country. Microscopy diagnosis is insufficient for accurate diagnosis and understanding of transmission routes as eggs of *Taenia solium* and *Taenia saginata* are indistinguishable and they can only be differentiated at molecular level.

In Malaysia, cases of neurocysticercosis had been detected but mainly among the immigrant workers from Myanmar and Nepal (Arasu *et al.*, 2005). Furthermore neurocysticercosis is extremely rare among Muslims simply because they do not consume pork nor even handle pork or pigs on religious grounds. A similar case of neurocysticercosis was recorded in another local Malay Muslim lady (Ibrahim *et al.*, 2003) who presented with headache and confusion. Her CT brain

scan showed pathognomonic cysts with invaginated scolex. Further serological testing for cysticercosis was strongly positive (Ibrahim *et al.*, 2003). Based on her travel history, other than going to Mecca for pilgrimage, this patient had not travelled overseas. One possible way of acquiring cysticercosis is through human to human transmission via food or water contaminated with *T. solium* eggs. Given that Malaysia is not *T. solium* endemic area, the source of human infections may most likely be migrant workers from neighboring endemic countries who work in restaurants across Malaysia. In the present case, the Malay Muslim man travels frequently on work assignments to Southeast and South Asian countries which are endemic for taeniasis and cysticercosis. He could have acquired the infection in one of his travels.

A study on a community-based screening in a rural population (Ranau, Sabah) of East Malaysia demonstrated anti-cysticercus antibodies in 3/135 (2.2%) people sampled indicating exposure to *T. solium* (Noor Azian *et al.*, 2006). Willingham *et al.* (2010) have reviewed the method of calculation by Noor Azian *et al.* and suggested that the seroprevalence in the Ranau community might have been underestimated by at least four-fold. This underestimation is likely to be true considering the non-Muslim villagers consume pork and keep pigs within their compounds. Another reason to support the underestimation hypothesis is that in villages, pigs are slaughtered at home and strict meat inspection for cysts is not carried out.

More recently, a study was conducted to examine the seroprevalence of human cysticercosis among seven Orang Asli subethnic groups in peninsular Malaysia. From a total of 522 randomly chosen individuals, 20 (3.8%) subjects were diagnosed positive for anti-cysticercus antibodies indicating that exposure to *T. solium* larval infection might have occurred in the aborigine communities (Sahu *et al.*, 2015).

In conclusion, as highlighted in these cases, taeniasis in Malaysia can be local or imported. As illustrated in case 2, it is important to couple conventional methods

of diagnosis with molecular tools for a more precise diagnosis. Although *T. solium* is associated with pigs, the transmission of cysticercosis is not necessarily through the consumption of pork and non-pork consumers are at risk too. It is important that this information is disseminated as misconception and confusion can occur in a multi-cultural society such as Malaysia.

Lastly, in trying to have a better understanding of rare parasitic infections, information needs to be freely available and shared among the experts in different institutions. Cases of taeniasis and neurocysticercosis are rare in Malaysia, therefore there are not many clinicians who have had experiences in managing patients with these infections. Moreover, Praziquantel is not easily available in Malaysia. Engaging in a multi-disciplinary effort in solving rare cases like these needs to be encouraged. This will enable improved diagnosis and heightened awareness among more clinicians, scientists and laboratory technicians.

Abbreviations

bid: twice a day; CSF: cranial spinal fluid, CT: computerized tomography; dNTPs: deoxynucleotide triphosphates; DNA: deoxyribonucleic acid; GP: general practitioner; H&E: hematoxylin and eosin; MRI: magnetic resonance imaging; NCBI: National Center for Biotechnology Information; PCR: Polymerase Chain Reaction; TWC: total white cell count.

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