CYSTICERCOSIS IN CAMBODIA, LAO PDR AND VIETNAM

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Abstract. Data in the international literature on *Taenia solium* taeniasis/cysticercosis in the former Indochina (Cambodia, Lao PDR, and Vietnam) are rather limited. Slaughterhouse reports and hospital records in urban centers indicate the presence of the parasite in the region. The prevalence of porcine cysticercosis in abattoirs is reported to be low. Sero-epidemiological studies in pigs are hampered by the presence of metacestodes of *Taenia hydatigena*, a common cestode in Vietnam that interferes with most serological tests for *T. solium* cysticercosis. Human cysticercosis is well known in northern Vietnam where between 100 and 150 patients are referred to specialized hospitals each year. Sporadic cases of cysticercosis are reported from central and southern Vietnam and from Lao PDR and Cambodia. Preliminary surveys in northern Vietnam have indicated that the seroprevalence of cysticercosis may be between 2% and 5%. In northern and central Vietnam, the occurrence of tapeworm carriers was found to be between 0.2 – 7.2%; however, these results are inconclusive, since they were based on various imperfect techniques and it is unknown with which species of tapeworm the people were infected. In addition to *T. solium*, which causes human cysticercosis, *T. saginata* and *T. asiatica* are also known to be present in Vietnam. In some areas typical risk factors are present for taeniasis/cysticercosis, such as traditional pig husbandry systems, inadequate meat inspection, and poor sanitation. Of particular interest are local practices that may facilitate transmission of *T. solium*, such as eating raw pork dishes, eating raw vegetables, and using human stools to fertilizing vegetable gardens and paddy fields. The availability of serological and neuroimaging techniques in referral hospitals has increased the diagnostic capacity of this zoonotic disease. Clinical manifestations of cysticercosis in humans include subcutaneous nodules, epileptic seizures, severe headache, impaired vision and memory loss. In contrast to endemic regions in Latin America and Africa, the majority of neurocysticercosis (NCC) patients also have subcutaneous cysts. Neuroimaging in NCC patients typically shows the presence of multiple cysts that are either viable or in different degenerative stages, or both. Albendazole has been found to be the best drug for treating cysticercosis though it is not totally effective in curing cerebral cysts. Until now, no measures for controlling this helminth zoonosis in the region have been taken.

INTRODUCTION

Data in the international literature on *Taenia solium* taeniasis/cysticercosis in the former Indochina (Cambodia, Lao PDR and Vietnam) are rather limited compared to those in the endemic regions of Latin America and Africa. Most research data have been reported in local journals in local languages and were, therefore, until recently rather inaccessible to the international scientific community. By compiling data from the local literature, Willingham *et al* (2003) reviewed the current status of cysticercosis in Vietnam. In contrast, taeniasis/cysticercosis remains very poorly documented in Cambodia and Lao PDR. The availability of serological and neuroimaging techniques in Vietnam during the last decade has had a major impact on the diagnostic capacity of this zoonotic disease. In recent years, hundreds of cases of neurocysticercosis and subcutaneous cysticercosis have been diagnosed and treated at referral hospitals in Vietnam. Recently, several epidemiological investigations on *T. solium* conducted in Vietnam, revealed some typical features of transmission patterns and clinical presentation in this country. However, some epidemiological questions also arose well, indicating the need for more in-depth studies.

This review is based on published data and on information collected through ongoing collaborative projects with the National Institute of Malariology, Parasitology and Entomology (NIMPE) and the National Institute of Veterinary Research (NIVR), both located in Hanoi.

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PREVALENCE OF PORCINE CYSTICERCOSIS

Surveys on porcine cysticercosis have been conducted primarily in northern Vietnam. Data from slaughterhouse reports have shown low infection rates. Between 1989 and 1993, in the slaughterhouses of

Hanoi, 799 cases (0.038%) of infections with *T. solium* were detected on a total of 2,091,000 pigs (Thuat and Lang, 1996). In this study, there was a trend of decreasing incidence, from 0.064% in 1989 to 0.018% in 1993. A similar trend was observed in another study at the Hai Ba Trung District slaughterhouse in Hanoi, from 0.085% in 1989 to 0.021% in 1993 among a total of 737,300 inspected pigs (Thuat and Lang, 1995). Between 1999-2000 a community-based serological survey of porcine cysticercosis was done in villages in Bac Ninh and Bac Kan provinces, using an antigen-detecting ELISA (Brandt *et al*, 1992). Thirty-two (9.91%) of 323 pigs sampled were positive by this test. However, necropsy of 10 serologically-positive pigs in that study revealed the presence of *Taenia hydatigena* cysticerci, while none were infected with *T. solium* (Doanh *et al*, 2002). This survey demonstrated the difficulty of assessing the prevalence of porcine cysticercosis by serological examination: the metacestode stage of the dog tapeworm *T. hydatigena* is commonly found in village pigs in Vietnam and its presence causes a cross-reaction in the antigen-detecting ELISA, making interpretation of the test unreliable. Nevertheless, this study and other observations in village pigs in Ha Tinh and Bac Kan provinces (unpublished results) indicated that the prevalence of and/or the intensity of infections with *T. solium* cysticerci is rather low in pigs. In the one reported study on porcine cysticercosis conducted in 1998 in southern Vietnam, a post-mortem survey of 891 pigs from 12 provinces indicated that 8 animals (0.9%) were positive (Huan, 1998). Although porcine cysticercosis has been reported in Cambodia and Lao PDR, prevalence data are not available.

PREVALENCE OF TAENIASIS IN HUMANS

Three species of *Taenia* infecting humans have been detected in Vietnam, *T. solium, Taenia saginata* and *Taenia asiatica* (Willingham *et al*, 2003). *T. saginata* was reported to be more common than *T. solium* (De *et al*, 1998a). Studies by De *et al* (1998a, 2001) report high prevalence of taeniasis (up to 7.2%) in northern and central Vietnam. However, these data must be interpreted with caution, since self-diagnosis of proglottids was taken as a positive result, without confirmation of eggs by coprological examination and/or expulsion of a tapeworm following treatment. Recent community-based studies with a more sensitive and specific copro-antigen detection method (Allan *et al*, 1992), revealed a prevalence of taeniasis below 1% in a mountainous province in the north and in a coastal province in central Vietnam (unpublished data).

Prevalence data on taeniasis in Cambodia and Lao PDR are not available. Old data from Lao PDR indicate that *T. solium* is more common than *T. saginata* (Le Francois, 1938).

PREVALENCE OF CYSTICERCOSIS IN HUMANS

Most of the information concerning human cysticercosis in Vietnam comes from hospital studies. Some of the hospital data reveal interesting clinical observations. However, it is not known how many patients find their ways to diagnostic centers in major urban centers. Patient records of NIMPE indicate that most cysticercosis patients presenting at the hospital, live in provinces close to Hanoi or near the important highways to the north or the south, with relatively easy access to the capital (Nguyen *et al*, 2003). The rural population in remote provinces which is believed to be most at risk, has no or little access and no financial resources for these medical and diagnostic facilities. The majority of the cysticercosis patients seen at referral hospitals are male (70% of a total 727 patients) (Willingham *et al*, 2003). An age distribution of cysticercosis patients seen at Hanoi hospitals between 1989-1990 indicated that over 50% were between the age of 30-50 years (Willingham *et al*, 2003). In southern Vietnam, a more equitable sex distribution was described with several juvenile cases (Tuan *et al*, 2001).

Reliable prevalence data are still very scarce and limited to areas where cysticercosis was known to be present. A few community-based surveys for cysticercosis have been conducted in north Vietnam, in the mountainous Province of Bac Kan, and in Bac Ninh Province in the Red River Delta, near Hanoi (Erhart *et al*, 2002; Somers *et al*, 2003). In both studies, nearly 5% were positive by antigen-detecting ELISA. The seroprevalence was lower (2%) in communities in the coastal province of Ha Tinh, in central Vietnam (unpublished results). In the study in Bac Ninh, 9 of the 12 sero-positive persons agreed to have their infection status confirmed, and 7 were found to have cerebral cysts by CT-scan while the other 2 were positive by biopsy of subcutaneous nodules (Erhart *et al*, 2002).

Human cysticercosis is present in Cambodia and Lao PDR as appears from several case reports (Firemark, 1978; Perry and Font, 1978; Knezevic *et al*, 1983); many Cambodian cysticercosis patients are referred to hospitals in Ho Chi Minh City for treatment (Tuan *et al*, 2001).

RISK FACTORS

Until now no risk analysis studies of taeniasis/cysticercosis have been carried out in former

Indochina. Several studies in Vietnam, however, have described some factors that are suspected risk factors for cysticercosis and taeniasis. These factors, including poverty, poor sanitation, traditional pig husbandry systems, and inadequate meat inspection, are still common in many remote areas of Vietnam. In other areas, urbanization is rapidly taking place, leading to improved living conditions and pig husbandry systems. In these localities, pigs are kept in piggeries and only piglets are allowed to roam freely; tap water is available and toilets are present and mostly being used. However, some typical factors are present in these more developed areas that may be important for the transmission of *T. solium.* These include eating raw pork dishes, such as *nem chua* and *nem chao*, considered to be an important risk factor for acquiring taeniasis, and eating raw salads, the use of human feces to fertilize vegetable gardens and paddy fields for acquiring cysticercosis. Moreover, some areas are very densely populated and have problems with waste and wastewater management. The high incidence of soil-transmitted nematode infections in Vietnam, even in urban and peri-urban areas (van der Hoek *et al*, 2003, Verle *et al*, 2003), indicates that important contamination of the environment with human stools occurs, and suggests an important fecal-oral transmission. Consequently, cysticercosis may in some ways be considered a soil-transmitted helminth in Vietnam. These particular epidemiological conditions may explain, at least partially, the noteworthy epidemiological finding of the low prevalence of porcine cysticercosis versus moderate to high prevalence of human cysticercosis.

CLINICAL PRESENTATION OF CYSTICERCOSIS

In Vietnam the most common clinical signs of cysticercosis are the presence of subcutaneous nodules and neurological symptoms, such as epileptic seizures, severe headache, and impaired vision (Willingham *et al*, 2003). Subcutaneous nodules are a very common and distinctive sign of infection, prompting referral for treatment. Studies indicate the chest, back, and arms to be the most common predilection sites (De *et al*, 1998a). Some patients may have substantial numbers of subcutaneous nodules with cases having over 300 recorded (Lam and Tan, 1992). Many patients have both subcutaneous nodules and cerebral cysticerci (De *et al*, 1998b; Nguyen *et al*, 2003).

Neuroimaging in neurocysticercosis patients in Vietnam typically shows the presence of multiple cysts that are either vesicular or vesicular/colloidal or in different degenerative stages, or both. The presence of multiple brain cysts is more common than single cysts. In some cases high intensities of cerebral cysts, exceeding 100, have been reported. A case of spinal cysticercosis was reported in Cambodia (Firemark, 1978).

Between 18.4% and 30% of cysticercosis patients are also having taeniasis (Lam and Tan, 1992; Nguyen, 1996; De *et al*, 1998b).

TREATMENT OF HUMAN TAENIASIS/ CYSTICERCOSIS

Praziquantel is most used to expell tapeworms. Single praziquantel treatment at a dose rate of 18 mg/kg was reported to give a 100% cure rate (De *et al,* 1998b). Niclosamide (2g/person) showed a lower efficacy (70-90%).

Treatment of cysticercosis is done either with albendazole (15 mg/kg for 20 days) or praziquantel (30 mg/kg for 10 days). Although albendazole was more effective than praziquantel in clearing cerebral cysts, the efficacy of both drugs is considered to be relatively low (De *et al*, 1998b), necessitating more than half of patients to follow a second or a third treatment course. After one or two unsuccessful treatment courses with one drug, the other drug is usually used for the next treatment. The potential to use Ag-ELISA to monitor the success of neurocysticercosis treatment is currently being investigated.

DISCUSSION

Based on the limited available data on taeniasis/cysticercosis in former Indochina a rather ambiguous situation is observed: the low prevalence of porcine cysticercosis (abattoir data) is suspect in consideration of the number of human cysticercosis cases being seen.

Therefore, more in depth studies are needed to study the epidemiology of the taeniasis/cysticercosis complex in the region. Countrywide community-based surveys in which people and pigs are examined in the same environment should be organised. For this purpose appropriate "toolboxes" should be established. Reliable tools for the diagnosis of human cysticercosis and taeniasis have been used in recent studies in Vietnam and a more specific serological test for porcine cysticercosis is currently under validation in this country. However, carrying out multidisciplinary studies in remote areas has proven difficult because of organisational and financial constraints. In these conditions, a different 'toolbox' may be used for initial assessment of infection, including easy-to-use tests with lower performance. Identification of high

transmission zones can be done by basic investigation of the three components of the life cycle of *T. solium*. Human cysticercosis can be assessed using questionnaires and/or clinical examination of subcutaneous nodules, because in Vietnam most neurocysticercosis patients also have subcutaneous nodules, and because it is more specific compared to investigating neurological symptoms. Lingual examination can be used to investigate porcine cysticercosis and assessment of taeniasis in humans can be done by questions on passing proglottids.

This information may help to assess the prevalence and the impact of the disease and finally provide the necessary data to design whether and what interventions might prove helpful to control cysticercosis.

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