CURRENT STATUS OF FOOD-BORNE PARASITIC ZOONOSES IN SINGAPORE

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Abstract. Parasitic infections adopt a rather low profile in the highly urbanized setting in Singapore. Very few food-borne parasitic infections are encountered. Apart from a few reports of infections with *Clonorchis/Opisthorchis, Taenia* spp. and hydatid disease, there are no other citations of such helminthic infections. Seroprevalence surveys have shown the presence of toxoplasmosis in local meat animals (sheep, pigs and cattle) and *Toxoplasma* strains have been isolated from the pig, tree shrew *(Tupaia glis)*, slow loris *(Nycticebus coucang)* and guinea pigs. Human toxoplasmosis is prevalent in Singapore. Anti-*Toxoplasma* antibodies are found in the normal population as well as in clinical cases (cervical lymphadenopathy, ocular disease and congenital toxoplasmosis).

Carcasses/organs from meat animals (sheep, pigs, cattle) slaughtered at local abattoirs were examined for parasites. The main parasites found were *Ascaris suum, Dictyocaulus, Metastrongylus, Cysticercus ovis, Fasciola hepatica* and *Sarcocystis* spp. Pigs were also examined for trichinosis and, thus far, these have all been negative.

INTRODUCTION

Singapore is a highly urbanized country with good housing and amenities. Consequently, one sees very few parasitic infections. However isolated pockets of rural slums still exist and some transmission of soil-transmitted parasites can occur. An aspect of parasitic infections that is becoming important is that of imported infections brought in by travelers coming to Singapore. Singaporeans themselves travel a great deal within the Asian region both for business and vacation and in this manner render themselves vulnerable to infection. The work force in Singapore has a large component of imported labor from neighboring countries, eg, Malaysia, Philippines, Indonesia, Thailand, Sri Lanka and Bangladesh. Some members of this large foreign labor pool could introduce parasites into the republic in spite of close vigilance on their health status. Foreign laborers are checked for malarial parasites but their intestinal/tissue parasitic fauna escapes such scrutiny.

Infections may also be acquired from ingestion of infected meat. Meat animals (cattle, pigs, goats) are purchased from neighboring countries and these may be a source of animal product-borne parasitic diseases. In Singapore there is a very little animal reservoir of such parasitic diseases. In this paper, an account is given of food-borne parasitic infections encountered in Singapore.

TREMATODE INFECTIONS

Ten cases of *Clonorchis/Opisthorchis* infections have been seen in local patients in the last 2 years (Singh, 1987). Most of the infections showed very few eggs in the feces and diagnosis was made by using formalin-ether sedimentation method. Most of the patients acquired the infection travelling in endemic countries and sampling the contaminated delicacies of these countries. A few patients with no history of visits to endemic areas probably acquired the infection locally through eating uncooked Chinese carp which are imported as fish fry from endemic regions (Kan and Cheah, 1970).

Opisthorchis may be important in Thai workers in the republic. There was a post mortem case of a

Thai worker in whom many adult flukes was seen in the liver. The Thai labor force in Singapore comes mainly from the provinces of northeastern Thailand where *Opisthorchis* infections occur frequently.

CESTODE INFECTIONS

Taenia infections are encountered rather infrequently. These have been diagnosed in patients from fecal specimens containing eggs/proglottids. Hydatid disease has also been reported by physicians. These diseases occur in patients who have acquired the infection from endemic areas and only manifest the disease in later years locally. A case of osseous hydatid disease had been reported from an orthopedic unit in a local hospital (unpublished data). A case of a solitary pulmonary hydatid cyst was reported from a 37 year old Indian woman (Teo *et al,* 1983). Although this patient was resident in Singapore for 20 years her infection was suspected to have been acquired during one of her visits to India. Her chest X-ray showed the typical feature of pulmonary hydatid cyst. Both the intradermal Casoni test and indirect fluorescence antibody test were positive for hydatid disease. The patient had presented with allergic manifestations due to a small rupture of the cyst and leakage of hydatid fluid.

PROTOZOAL INFECTIONS

Seroprevalence surveys were carried out in animals and humans using the direct hemagglutination (IHA) technique, as developed by Jacobs and Lunde (1957), and subsequently the indirect fluorescence antibody (IFA) technique.

Sera from local household and meat animals were examined for anti-*Toxoplasma* antibodies (Singh *et al,* 1967; Zaman *et al,* 1967). A total of 616 animal sera were examined. Of these 125 (20.5%) were positive for antibodies. The positive rates ranged from 4.5% in chicken, 20.7% in cats, 25% in sheep and 27.7% in pigs, to 35.7% in cattle. A prevalence rate of 28.7% was seen in rats. None of the sera from 28 pet dogs was positive. The results showed that *Toxoplasma* was present in local domestic and meat animals. The low antibody levels in chicken suggested that they may not be an important reservoir of infection. A high prevalence rate of 27.7% was found in pigs with titers in the range 1:400 - 1:1,600. Five pigs with high positive titers were slaughtered and brain tissue examined (Zaman *et al,* 1967). Two of the brains showed *Toxoplasma* cysts by squash preparation and Giemsa stain of smears. Parasites were isolated by intraperitoneal inoculation of brain tissue into mice. The strain was maintained in white Swiss albino mice by passage every 4-5 days. The parasites also grew well in primary monkey kidney tissue cultures (Zaman and Yin-Murphy, 1969).

In further investigations on toxoplasmosis in animals, cyst-forming strains of the parasite were isolated from the Malayan tree shrew, *Tupaia glis* (Zaman and Goh, 1970), the slow loris, *Nycticebus coucang* (Zaman and Goh, 1968; Zaman and Krishnamurti, 1969) and from a population of guinea pigs reared for experimental purposes (Singh *et al,* 1971). In the latter study 24% (39/140) of apparently healthy guinea pigs were serologically positive, 27 of the guinea pigs had titers of $\geq$ 1:1,600 or higher. On post-mortem examination all these guinea pigs showed *Toxoplasma* cysts in the brain. The parasite was isolated by passage in laboratory mice. Cats fed with infected mouse brain showed oocysts in the feces 5 days later and these were seen up to 11 days. The guinea pigs were thought to have been infected by stray cats that often entered their play pens.

Singh *et al* (1968) examined sera of apparently healthy individuals for anti-*Toxoplasma* antibodies by the IHA test. A positive rate of 17.2% was seen. A rather high positive rate of 41.3% was obtained in clinically suspect cases at titers of 1:100. These early studies emphasized the clinical importance of toxoplasmosis in Singapore and also suggested a rather high level of transmission in the population. The distribution of antibody titers in the various ethnic groups in Singapore was examined (Zaman and Goh, 1969) and it was found that Malays and Indians had higher positive rates than Chinese. In 569 Chinese, 92 Malays and 93 Indians tested, positive titers ($\geq$ 1:100) were obtained in 21.8%, 39.2% and 36.6% respectively in the three groups. The fondness for cats amongst Malays was reckoned to be a reason for the high titers.

Lim *et al* (1982) used the IFA test to study 803 sera from clinically suspected cases and found a positive rate of 42.5% at titers $\geq$ 1:16; 17.5% of these sera had titers $\geq$ 1:64. Again, Malays and Indians were found to have higher positive rates

than the Chinese. This 1982 study had results similar to the study done in 1968, indicating that over a period of 10 years the rate had not changed. This indicated a steady level of transmission in the local population.

The importance of congenital toxoplasmosis was suggested in a study (Singh *et al*, 1972) in a maternity hospital where cord blood was examined by the IHA test and antibodies were detected to *T. gondii*. This study however did not distinguish between maternally-transferred IgG and IgM resulting from active infection. Clinically, cases of congenital infection have been reported (Paul, 1967; Lim, 1967). Routine diagnosis of ocular cases from the eye departments of local hospitals have revealed antibodies to *Toxoplasma* indicating the role of this organism in causing ocular lesions.

More recently, Mohan *et al* (1990a) analyzed by IFA test anti-*Toxoplasma* titers in sera from 80 normal healthy adults and 2,185 patients' sera samples from various clinics and hospitals in Singapore. About 15% of healthy adults were found to have titers ranging from 1:64 to 1:256 while 3.75% had titers $\geq$ 1:1024. Among the patients investigated for toxoplasmosis, they found that more than 20% of those presenting with lymphadenopathy (usually cervical) had antibody titers $\geq$ 1:1024. More than half of all patients with an antibody titer of 1:4096 and more than three quarters of all patients with a titer $>$ 1:4096 had presented with lymphadenopathy. About 20% of those presenting with ocular symptoms had antibody titers of 1:64 or 1:256 whereas 7% had higher titers. About 25% of still-births were associated with positive anti-*Toxoplasma* antibodies, with a modal titer of 1:64. These workers also report higher seropositive rates in Malays and Indians, compared to the Chinese.

Mohan *et al* (1990b) further undertook a retrospective study to examine the clinical presentation and management of 58 patients with IgG serotiters $>$ 1:1024 by the IFA test. About 60% of these patients had presented with lymphadenopathy, 20% with ocular symptoms, and 14% with poor obstetric history. Almost all patients with IgG anti-*Toxoplasma* titers of $\geq$ 1:1024 had presented with lymphadenopathy (with a modal titer of 1:4096). In contrast, most of the patients who presented with ocular symptoms or poor obstetric history had lower modal titers. The majority of patients who had presented with lymphadenopathy were Chinese, aged 21-35 years. They presented with a painless mobile solitary cervical node of 3-4 weeks duration as the only symptom. The histopathology of the biopsied nodes was suggestive of toxoplasmosis. They were not treated and had no sequelae. These authors concluded that acute toxoplasmosis is common in Singapore and presents typically as an asymptomatic cervical lymphadenopathy in young Chinese. The incidence of congenital infection was believed to be high, based on the number of cases presenting with fetal wastage and prevalence of ocular toxoplasmosis. They were of the view that pigs constituted an important reservoir for the transmission of this disease to humans.

In a community study done in 1988 in a racially mixed area of Singapore, various possible risk factors were analyzed and their importance in transmission of toxoplasmosis was assessed (National University of Singapore, 1988). Cat ownership as well as cat contact were found to play a key role in transmission of infection. Cooking and eating habits also contributed to transmission and toxoplasmosis. In Malays, contact with raw meat (mutton and beef) appeared to increase susceptibility to infection, while in chinese, consumption of beef played an important role.

With increasing use of organ transplantation in Singapore, problems associated with immunosuppression therapy emerge. There are parasitic infections which can flare up in patients undergoing such therapy. Apart from toxoplasmosis, there are opportunistic infections that may pose problems in management. *Pneumocystis carinii* is one such candidate. Clinical cases of pneumocystis pneumonia with parasitological confirmation have been seen in Singapore. Diagnosis is done on bronchial aspirate smears by Gomori's silver stain. Other protozoans which may be important are *Nosema (Encephalitozoan) cuniculi* and *Sarcocystis. Nosema cuniculi*, a microsporidian, is a common parasite of insects parasitizing different groups, including humans. It infects laboratory animals, especially rabbits and mice, and persists as a chronic latent infection. In Singapore sera from laboratory-reared rabbits were screened for antibodies to *N. cuniculi* by the IFA technique and 75% of 40 rabbits examined were positive for

antibodies to *N. cuniculi* (Lim *et al,* 1986). One hundred and twenty-five human sera examined in Singapore were negative for such antibodies except for one serum (Singh *et al,* 1982). Anti-*Nosema* antibodies were found in Orang Asli (aborigines) in Malaysia. These studies indicated presence of the parasite in this region. Its role in producing infections in healthy individuals is still rather dubious. *Sarcocystis* spp. have been reported in various meat animals, such as pigs, sheep, goats and cattle. Animals slaughtered in the local abattoirs are routinely screened for *Sarcocystis* infections. Recently, only sheep have been reported to be infected with this parasite. It can produce infection in humans and in the intestine it produces oocysts which are detected in the feces as *Isospora* spp. *Isospora* infections are rather rare in Singapore. A protozoan parasite which is assuming increasing importance in the world in immunosuppressed individuals, expecially those suffering from AIDS, in *Cryptosporidium.* So far this infection has not been reported in Singapore, although in Malaysia there has been a single report of such a case (Ghani *et al,* 1984).

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