Challenges in Parasitology: A Sri Lankan perspective

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The Ceylon Journal of Medical Science 1995; 38: 25-29

Professor Dissanaike, Chairman, Ladies and Gentlemen,

It is a privilege to participate in this felicitation ceremony to honour so eminent a scientist as Prof. A. S. Dissanaike. I thank the organizing committee for giving me this opportunity.

Over 20 years ago on my first day as Lecturer in Parasitology, I faced the very first challenge at the job. Dr. Gamini Hettiarachchi of Physiology, a former teacher of mine, brought a specimen of a mosquito and said "I found this on my wall, can you tell me whether it is the malaria vector?" Not having any senior staff member to seek advice from, I realized then that my knowledge was totally inadequate to meet the future challenges in order to survive at the job.

Identification of uncommon parasites

Species identification, especially of uncommon human parasites has always been a daunting task for those of us without a basic zoology training. A. S. Dissanaike, having an in-depth background of zoology, emphasized the value of surface morphology in identification. Perhaps this is best illustrated in his study of lung flukes recovered from different sylvatic hosts in Sri Lanka, in which meticulous study of the morphology of the cuticular spines enabled species identification (1). Children, in particular are prone to infection with uncommon parasites due to their 'dirt-eating' habits. *Bertiella studeri*, a tape worm of monkeys is one such example. First reported by Edirisinghe and Cumararajan in 1976 (2), the size and shape of the segments is unlike that of the common tape worms infecting humans. It is noteworthy that a year later Dissanaike reported the very first case of *Bertiella studeri* infection in Malaysia establishing this as a zoonotic infection (3). *Dipylidium caninum* the common tape worm of dogs is yet another tape worm which we have seen infecting children (4). The highly contractile, cucumber seed like gravid segments has a fluke like appearance but on staining shows the double uterine pores and egg pockets characteristic of this parasite. Another problem that we faced recently was the identity of nematode larvae around 1.4 cm in length. On the characteristic glandular part of the oesophagus and the anterior boring tooth they were identified as *Anisarkis spp* L3 larvae. These larvae are known to cause anisakiasis in man, resulting in intestinal lesions. Identified as a human health risk since the 1960 s, infection is not uncommon in populations consuming raw or undercooked marine fish (5).

Animal experimentation

Unravelling the pathogenic processes is of fundamental importance in the study of disease caused by parasites. An area receiving renewed attention is that of intestinal nematode infections, notably that caused by the large round worm *Ascaris lumbricoides*. Although accepted as a pathogen since ancient times, infection received scant attention due largely to ill defined morbidity and limited mortality. It is now recognized that these parasites could have nutritional effects, having an impact on both physical growth during the formative years and even impair cognitive performance in later years. However, studies present many difficulties such as variables in intensity of infection, concomitant multiple worm infestations, sampling difficulties and variations in host factors. Even in well planned studies

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carried out so far the results have been inconclusive. In such situations controlled animal experimentations are indicated. Unfortunately in *Ascaris lumbricoides* although lung migration of larvae occur, laboratory animals do not support the complete development to adult stage.

Toxocara canis is a closely related round worm of dogs which affects puppies less than six months of age, resulting in poor growth among its other effects. In collaboration with the Department of Clinical Veterinary Medicine, University of Cambridge, we carried out absorptive and histopathology studies using the small intestine of puppies infected with moderate and low worm burdens (6). The heavily infected puppies showed a significantly reduced xylose absorption but minimal change in absorption of para-aminobenzoic acid (PABA). Fat assimilation was significantly reduced while the faecal proteolytic activity showed an increase, reflecting digestive incompetence. Histopathology studied on acrylic embedded thin sections showed a significant reduction in villous height related to heavy infection. Impairment of the protective surface mechanisms of mucous secretions was evident with reduction in luminal goblet cells and increase in crypt goblet cells suggesting an increased turnover in the heavily infected. The Intra Epithelial Lymphocytes (IEL), comprising the cytotoxic/suppressor T lymphocytes with the CD8 surface marker were significantly raised in the heavily infected, indicating the importance of the cellular immune mechanisms in the gut response to nematode infection. However, there was no significant increase in plasma cells in the lamina propria. This study demonstrates that *T. canis* infection in puppies provides a reliable and readily manipulated animal model for the study of childhood ascariasis.

Malaria outbreaks in new foci

I would now shift from the laboratory to challenges met with in the field, to focus on the changing geographical distribution of malaria in Sri Lanka. In Sri Lanka, malaria is endemic in the dry zone while much of the wet zone is traditionally regarded as non-malarious. This is largely due to the preferred breeding habits of the major vector *Anopheles culicifacies sp B* being water pools in the river and stream beds. The waters of the major river Mahaweli, downstream, has been harnessed from ancient times for human use. However, more recently, the Mahaweli has been subjected to major irrigation, hydropower and human settlements with the building of dams, reservoirs and power plants, upstream. Three major construction works viz., Kotmale, Polgolla and Victoria are situated in the populated, traditionally non-malarious Upper Mahaweli Region. In 1986, associated with the increase in incidence of malaria in the endemic areas, several outbreaks of malaria occurred in this region. One such outbreak which we studied was that at Waratenna village just outside the Kandy city limits (7). A case concentration of *Plasmodium falciparum* was seen within 1km on the left bank of the Mahaweli. Of the inhabitants in this region 84% were long term residents with no previous exposure to malaria. Evidence of chloroquine resistance was seen, with over 53% patients having multiple attacks despite the use of the then recommended alternative antimalarial amodiaquine (8).

By setting up a diagnosis and treatment centre in the study site and utilizing the Peradeniya hospital for indoor treatment and follow up, with the assistance of the Anti Malaria Campaign, we were able to contain the outbreak using sulphadoxine-pyrimethamine. A seroepidemiological study using a synthetic peptide (NANP40) sportozoite ELISA confirmed the nature of the outbreak with 91% of patients loosing the antibodies in a one year follow up, in the absence of transmission in the area (9).

Many factors contributed to this outbreak. A notable feature of the Mahaweli is the alternating rock and sandy nature of the river bed. Between Peradeniya and Victoria the river bed is largely rocky with 'pothole' formation due to river currents. The priority at Polgolla barrage is water diversion to Ukkuwela for hydro power generation and it is only the remaining water that is sent downstream.

Usually, the river discharge is sufficient to inundate the rock pools in the river bed. But with low river discharge, extensive pool formation is seen below the barrage. Further, the gradient of the river is low, with a fall of 2.4m/km compared to the average 9.5m/km for the upper region. Therefore, in the event of a sustained low discharge the rocky bed is subjected to extensive pool formation, ideal for malaria vector breeding.

The year previous to this outbreak recorded an unusual drought. Further, the river discharge at Peradeniya indicated a retention effect of the Kotmale reservoir which was commissioned in August 1985. Yet another major contributing factor was the relocation of families downstream in malaria endemic areas, resulting in 'to and fro' population migration with parasite carriage from the malaria endemic areas.

The role of migrants in initiating malaria outbreaks in this region has been further studied by one of our students, P H D Kusumawathi of the Anti Malaria Campaign. These studies identified five such outbreaks during the period 1989-1992 along the major river associated with water diversion, viz., Hatlaha, Illagolla, Gangasirigama, Nugawela and Bogolla (10). The outbreak at Illagolla was associated with vector breeding in rockpool formations below the dam on Nilambe Oya (11). In all five foci it was established that outbreaks were initiated due to parasite carriage by migrants. The results of this study points to the need to target migrants in malaria prevention and control. Yet another factor revealed was the treatment delay, and highlights the urgent need to update knowledge of medical practitioners, particularly those in non-endemic areas, on malaria diagnosis and treatment to ensure early therapy and limit parasite carriage.

Parasitic disease associated with foreign travel

Next I wish to focus on parasitic disease and foreign travel. Many of the major parasitic diseases are geographically restricted due to complex life cycles, requiring specific vectors and reservoir hosts, while others are of limited distribution in populations due to peculiar behavioural and food habits. From ancient times travel links have existed between Sri Lanka and India and diseases such as visceral leishmaniasis, hydatididosis, cysticercosis, guinea worm infection prevalent in India have been recorded in travellers. Dissanaike reported the very first trematode infection, a case of *Philophthalmus* infection of the eye in a Sri Lankan acquired accidentally during a visit to South India (12).

However, the 1980's have brought on a world-wide travel boom and it is stated that for Asia and the Pacific the major health issue of the 1990's is not population increase but population migration. Inexpensive, convenient air travel coupled with relaxation of exchange and travel restrictions have enabled people to undertake overseas travel, for employment, education, tourism and pilgrimages. The Sri Lankan migrants to Arab-African countries increased from 12,000 in 1977 to 70,000 in 1983 and 42% of these are short term travellers with less than two year stays.

In 1986, we detected the first case of urinary schistosomiasis in a Sri Lankan, infection acquired in Mali, West Africa (13). The patient presented with haematuria but there was a delay of over 12 months in diagnosis, partly due to patient ignorance and partly due to non recognition of the clinical presentation by the medical practitioners. Cystoscopy showed typical lesions which on biopsy showed the granulomatous nature and the urine examination showing the typical eggs of *Schistosoma haematobium* confirmed the diagnosis. By screening the rest of the group exposed to this risk we were able to detect an asymptomatic patient with early disease (14). Early diagnosis is of considerable importance for a favourable prognosis in conditions such as urinary schistosomiasis.

Several other parasitic infections associated with foreign travel have been reported recently. These include a case of infection caused by *Loa loa* acquired in Nigeria, reported by Wickremasinghe et al in 1989 (15); two cases of cutaneous

leishmaniasis acquired in Nigeria and Iraq reported by Naotuune et al in 1990 (16) and a case of myiasis causing scalp furunculosis due to the Tumbu fly infection acquired in Zimbabwe, reported by Edirisinghe and Rajapakse in 1991 (17). The current travel trends with offers of African safari tours and visits to mainland China undoubtedly would widen this spectrum of health risks.

The problems associated with imported disease are many. The health services are ill-equipped to deal with non-endemic disease. Due to non-familiarity of clinical features and non-availability of laboratory confirmation, there are inevitable delays in diagnosis. Further, unlike in endemic disease, high morbidity and mortality could be met with in non-immunes. Management causes further problems in specific drugs not being readily available. Yet another danger is the establishment of local transmission with parasite carriage. In this respect a threat which is of concern is the introduction of multi-drug resistant falciparum malaria.

Future needs

Improved laboratory diagnostic techniques have enabled the identification of new pathogens. In the field of parasitology this is particularly applicable to the intestinal coccidian parasites. Currently, *Cryptosporodium* spp and *Isospora* are recognized as pathogens. Recently yet another coccidian *Cyclospora cayetanensis*, having the similar acid-fast staining properties but with larger oocyst has been described as a human parasite causing diarrhoea (18). In the immunocompromised these coccidian infections could be fatal. Parasites, particularly intestinal protozoans which were earlier considered as harmless commensals are now thought to be potential pathogens. *Dientameba fragilis*, *Iodamoeba buetchlei* and *Blastocyctis hominis* are among this group. Further, molecular techniques need to be applied to characterize our parasite strains. Therefore there is a need to improve our diagnostic skills to study parasitic infections in local populations.

An important parasitic health risk recently described is the occurrence of local transmission of cutaneous leishmaniasis. Following the first report of a case from Ambalantota by Athukorale et al in 1992 (19), we were associated with the dermatologist J. K. K. Seneviratne, in detection of another case of cutaneous leishmaniasis acquired in Bibile, thus establishing local transmission and its risk as a zoonotic disease in our dry zone scrub jungles (20). Much work needs to be carried out to establish the vectors, reservoir hosts and natural cycles in Sri Lanka.

We are indeed indebted to Prof. A. S. Dissanaike for the wide contributions he has made to broaden the knowledge of parasitic disease in Sri Lanka and for giving us the proper direction for further study in this field.

We wish Prof. Dissanaike many more happy, and contended years in the study of parasitic disease.

Thank you.

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