Interview

Prof. Hector H. Garcia, MD, PhD.

Prof. Hector H. Garcia, MD, PhD; Head of the Cysticercosis Unit of the National Institute of Neurological Sciences in Lima, Peru, Director of the Center for Global Health-Tumbes, and Professor at the Department of Microbiology at the Universidad Peruana Cayetano Heredia in Lima, Peru. Prof. Garcia is a Wellcome Trust Senior International Research Fellow in Public Health and Tropical Medicine and a Coordinating Member of the Cysticercosis Working Group in Peru.

Neurocysticercosis is a global health problem and is majorly responsible for the high prevalence of epilepsy in the developing world. Despite the introduction of potent cysticidal drugs, this parasitic disease continues to pose a threat to millions of people living in these areas. More recent efforts, directed to interrupt all inter-related steps in the life cycle of the causal agent, the pork

tapeworm *Taenia solium*, will undoubtedly reduce the impact burden of the disease. In this regard, the work of Dr. Hector H. Garcia is commendable, as he is co-directing a large-scale control program for the disease complex Taeniasis-cysticercosis in Tumbes, Perú, whose final results we are anxiously waiting.

NCC is a major neglected disease that deserves much more attention. What is the size of the problem and in which regions is it most prevalent?

Taenia solium is endemic in most poor regions of the world including Latin America, Sub-Saharan Africa, Southeast Asia, and vast parts of China, and is also present in non-endemic countries due to migration and travel. Where it is endemic, it accounts for approximately 30% of seizure disorders and epilepsy, thus causing a significant burden of chronic neurological morbidity and increased mortality.

Are there signs of improvement in morbidity and mortality rates?

While mortality caused by cysticercosis has clearly decreased in the past two decades thanks to improved diagnosis and monitoring as well as better therapies, including minimally invasive neurosurgery, exact numbers are not available. The numbers of cases in endemic countries seem to persist in very high levels, perhaps decreasing in urban regions but not in rural regions.

Can you elaborate on the transmission route of NCC?

NCC is the infection of the human nervous system by the larval form

of the pork tapeworm, *Taenia solium*. It is normally passed between humans and pigs. The adult *T. solium* tapeworm resides in the small intestine of humans and liberates its infectious eggs into the environment with the stools. Once in the environment, free-roaming swine ingest *T. solium* eggs in the soil or in human feces, the ova hatch, penetrate the intestinal wall, and reach the blood stream. They are then carried to the tissues of the pig where they develop into cysts in 2–3 months. The life cycle is completed when humans ingest undercooked pork with cysts and develop intestinal taeniasis. Humans develop cysticercosis after accidental ingestion of ova via fecal oral contamination. Thus, human NCC occurs from human-to-human transmission and infected pork does not play a direct role.

What precautions are taken to prevent its spread and what can be improved?

While NCC cases are clinically interesting and have gained the attention of clinicians, from an epidemiological point of view the most important player in transmission is the human tapeworm carrier, which is usually asymptomatic. Identification and treatment of *Taenia solium* carriers decreases further transmission. Unfortunately, the most common diagnostic tool for taeniasis, microscopic stool examination, is not especially sensitive. More sensitive immunological tools are seldom available in clinical settings. Increased search for and

Interviewed by Christo Hall, Editorial Assistant, Pathogens & Global Health, Imperial College, London, UK

treatment of taeniasis cases in clinical and endemic field settings stands as the most efficient individual measure to decrease transmission, albeit comprehensive control programs will require other concomitant interventions to optimize their effects.

There are often few or no symptoms, what challenges does this create?

A significant proportion (10 to 20%) of villagers in endemic regions have parenchymal brain calcifications, apparently silent (detected when brain CT is performed by other reasons). To date it is not known whether these lesions may be associated with more subtle symptoms, or with a higher risk of later seizures.

Are innovations in brain imaging technology having a significant effect on diagnosis and treatment?

Yes, the introduction of CT changed the perception of the disease and presented the opportunity to monitor the effects of antiparasitic treatment. Later, MRI and MRI spectroscopy added further imaging information. However, we should not forget that many endemic villages do not even have access to CT, and even where the machines exist, the costs of the test may be too expensive for poor villagers.

Explain the link between NCC & epilepsy?

In endemic countries, NCC is frequently the etiological agent of lesions associated to epilepsy in clinical centers. However, the high frequency of asymptomatic lesions, as well as the high background seroprevalences of specific antibodies in endemic regions has confused researchers and led some groups to wonder

whether the relation is real or an artefact. When appropriate control groups are used, individuals with NCC are 2 to 3 times more likely to have seizures than individuals without NCC. The association is much more evident in individuals with multiple parenchymal lesions.

Are there further concerns brought about by HIV coinfection?

Not really. The behavior of NCC in the presence of HIV is not well described beyond a few small case series and there is not enough information to determine whether HIV infected individuals are more prone to NCC infection, or if they will have more or less symptoms, or whether they could be more prone to disease progression. A better understanding of this interaction may unveil immunological and pathogenic pathways.

What are the prospects of developing novel effective treatments?

There are tremendous prospects. The efficacy of antiparasitic regimes is sub-optimal and more effective drugs or drug combinations are required. Some are already being assessed in clinical trials including the simultaneous use of albendazole and praziquantel. Concomitant anti-inflammatory medication, particularly steroids, needs to be better defined in terms of doses and length of therapy, and perhaps new anti-inflammatory agents could have a role. Even for antiepileptic drug therapy, whether it should be maintained for at least two years as in other epilepsies or can be shortened to a few months until inflammation subsides is not supported by

controlled data. Of particular interest, the efficacy of the treatment for intestinal taeniasis needs to be improved to sustain control strategies, and whether mass praziquantel can be safely used in cysticercosis-endemic regions is still to be demonstrated.

How significant is WHO's recognition of NCC and echinococcosis as 'two major neglected diseases'?

It is very late but still useful. Recognition by WHO should drive other agencies and governments to pay more attention, and support research and control of these unattended diseases in the near future.

Why is it still regarded as neglected? Should more funds be available for research, drug development and diagnosis?

In comparison with other infectious diseases, there is an almost complete lack of control efforts, and insufficient funding for research, resulting in delayed development of diagnostics and slow improvements in treatment. Appropriately designed studies quantifying the burden of disease and associated costs are needed to force decision makers to allocate more resources into taeniasis/cysticercosis research and elimination efforts.

What are the hopes for elimination and eradication?

Very good. Recent data from Peru suggests that a combined intervention, including human and pig treatment plus porcine vaccination can interrupt transmission. Further work is now ongoing to optimize control strategies and make intervention tools more widely available and cheaper.