

Cross-species transmissions of simian retroviruses in Africa and risk for human health

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Emerging zoonotic diseases are among the most important public-health threats facing humanity. One of the major examples is the AIDS epidemic which emerged in the 1980s as a result of cross-species transmissions of simian immunodeficiency viruses (SIVs) to human beings several decades earlier.^{1,2} As with HIV, other retroviruses (such as human T-lymphotropic viruses 1 and 2) are also of zoonotic origin, with multiple cross-species transmissions of simian T-lymphotropic virus 1 between primates and human beings.^{3,4} The risk of acquiring such infections is expected to be highest in individuals who are regularly in contact with primates, by hunting or preparing primates for food or by keeping primates as pets.

In this week's *Lancet*, Nathan Wolfe and colleagues describe the transmission of another group of simian retroviruses, simian foamy viruses, into the human population in the tropical forest area of Cameroon. More than 1000 individuals having regular contact with non-human primates were tested; ten had antibodies to simian foamy virus, and infection with this virus was confirmed by PCR in three of them. Each simian foamy virus infection was acquired from a distinct lineage of the virus, involving cross-species transmissions from three different primate species. Although Wolfe and colleagues could not report direct evidence of contact with the corresponding primate host, their data show that, in addition to simian foamy viruses and simian T-lymphotropic virus, other simian retroviruses have been transmitted to human beings in Africa.

These three simian retroviruses (SIV, T-lymphotropic, and foamy) are not pathogenic in their natural hosts, but crossing the species barrier can lead to disease in the new hosts. The most striking example is infection with SIV; but it must be noted that different SIVs are associated with different disease characteristics in human beings. As such, HIV-2 derived from SIVsm from mangabeys is less pathogenic and less transmissible than HIV-1 originating from SIVcpz from chimpanzees.^{5,6} Also, HIV-2 infections remained restricted to West Africa, whereas HIV-1 spread globally.^{7,8} The prevalence of human T-lymphotropic virus is highest in the tropical forest region of equatorial Africa,⁹ but by contrast with HIV only a few individuals who are infected with this virus will develop disease after a very long incubation period. Human T-lymphotropic virus 1 is associated with lymphoma, leukaemia (adult T-cell leukaemia), and some neurological disorders such as tropical spastic paraparesis, but human T-lymphotropic virus 2 has as yet no clear pathogenicity.^{10,11}

For foamy viruses, no disease has yet been observed in human beings, human-to-human transmission has not yet been shown, and there are almost no data on the occurrence of foamy viruses in human beings.^{12,13} But if foamy viruses also behave like HIV and human T-lymphotropic virus and produce different diseases when different simian foamy viruses are involved, it cannot be excluded that the pathogenicity of foamy viruses with a particular simian strain might emerge in the human population after a long incubation period, and especially as life expectancy increases. Because of Wolfe and colleagues' findings, studies will now need to be started to examine whether in these natural settings in Africa human-to-human transmission occurs with foamy viruses and whether any disease is associated with these infections. Such epidemiological

surveys in rural African populations will show whether the (simian) human foamy virus infections described in Cameroon are isolated dead-end cross-species transmissions or whether, as with human T-lymphotropic virus, clusters of human infections with foamy viruses exist in Africa.

Wolfe and colleagues thus extend our knowledge of the range of simian retroviruses that have crossed the species barrier from primates to human beings in Africa. As such, the possibility of transmission with other simian retroviruses, especially SIVs leading to a new HIV, cannot be excluded. In Cameroon, human beings are exposed to many SIVs and simian T-lymphotropic viruses, which occur at high prevalences (16% and 11%, respectively) in primate bushmeat or animals kept as pets.^{14,15} Bushmeat hunting has been going on for a long time throughout sub-Saharan Africa, but other factors have increased the potential for human exposure to a wide range of primates over the past decades. Commercial logging is an important economic activity in west-central Africa, and has led to road construction into remote forest areas, human migration, and the development of social and economic networks (including those of sex workers) which support this industry. We recently found¹⁶ a high prevalence of HIV among young women in a logging area in Cameroon, suggesting that environmental and socioeconomic modifications related to this industry could facilitate dissemination of HIV and subsequently have a major role in the spread of new retroviruses in the human population. As a consequence, human infection with simian retroviruses (which have a long incubation period) might spread unrecognised for several years and lead to another disease epidemic.

Use of non-invasive methods for the identification of the simian counterparts of these viruses could therefore serve as sentinels by signalling which pathogens might pose a risk for human beings. Subsequent early recognition of human infections will then allow rapid implementation of control measures to limit spread of these zoonoses. Alternatively, reducing contact between primates and human beings by limiting hunting of primates as bushmeat and providing alternative protein sources in these remote areas, as well as informing local populations about diseases that can be transmitted from primates to human beings, might also help to prevent cross-species transmissions.

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Purging the worm: management of *Taenia solium* taeniasis

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Taenia solium or pork tapeworm, a cestode, can cause two forms of human infection. Infection with the adult tapeworm, which resides in the small intestine, occurs only in those who consume uncooked or partly cooked pork infected with cysticercus cysts (measly pork) and results in taeniasis. Cysticercosis is the infection of human beings (and pigs) by the larval stage of the parasite that occurs by the consumption of food that has been contaminated with *T solium* eggs passed in the stools of taenia carriers. Human beings are the only known definitive hosts although pigs and human beings can be intermediate hosts. About 50 million individuals worldwide have cysticercosis.¹

Taenia carriers have a pivotal role in the causation of cysticercosis and perpetuation of disease transmission in the community.² They can infect themselves with the eggs passed in their stools (autoinfection), resulting in concomitant taeniasis and cysticercosis. Not only are taenia carriers responsible for cysticercosis in pigs, but food handlers with taeniasis can also cause cysticercosis by contaminating food with their unclean hands. Therefore identification and treatment of patients with taeniasis is crucial, not only to reduce the risk of cysticercosis in the patients themselves but also to eliminate the risk of cysticercosis in their contacts and to control the disease in the community at large. Indeed, mass treatment with taeniacidal drugs has been suggested as one of the control measures for cysticercosis in endemic regions.³ Given this background, it is surprising that the management of taeniasis has received scant attention. The report by Cesar Jeri and colleagues, in this issue of *The Lancet*, on an improved protocol for the management of taeniasis is therefore important.

Taeniasis, unfortunately, is often a silent disease with most patients remaining asymptomatic and unaware of their disease. Patients seldom seek treatment for the passage of segments of the tapeworm (proglottids) in their stools. Questioning those who consume pork in endemic regions, with visual aids depicting the pro-

glottids or showing a specimen of the proglottids, is an important tool for the identification of patients with taeniasis.⁴ Microscopic examination of stools for taenia eggs has a low sensitivity and furthermore is unable to distinguish *T solium* from *T saginata* (beef tapeworm) infestations, the latter being an innocuous infestation by comparison.⁵ The coproantigen test detects antigens of *T solium* in stools and is presently the most sensitive and specific diagnostic test for the diagnosis of *T solium* taeniasis.⁶ Because taenia carriers pose considerable risk to themselves and the community,² treatment for taeniasis should be offered to anyone who reports passage of tapeworm segments, has taenia ova on microscopic examination of stool, or has a positive coproantigen test. Taeniasis is treated with a single oral dose of niclosamide or praziquantel. A purge is necessary after the administration of either drug, and cure is confirmed by the recovery of the scolex (head) of the parasite in stools.

The protocol suggested by Jeri and colleagues consists of administering a purgative (electrolyte-polyethylene-glycol solution [EPS]) before and after niclosamide treatment, and it led to an increased recovery of the tapeworm scolices, proglottids, and eggs compared with a conventional post-treatment purgative regimen (castor oil). The benefits of Jeri's protocol include easier and faster speciation of the worm (*T solium* vs *T saginata*) and assurance of a cure in those from whom the scolex was recovered. The mechanism of action of their protocol and, indeed of EPS, in achieving a more effective expulsion of the tapeworm and its parts is unclear. Does their purge protocol improve cure rates or only improve recovery of the parasite and its parts after treatment with niclosamide? If the former is true, then is it due to a better exposure of the worm to the taeniacidal drug after the pretreatment purge? Also, the rapid purge with EPS after niclosamide treatment might prevent disintegration of the parasite, leading to easier identification of the parasite and its parts in stools. Even with the EPS regimen, the scolex was recovered in less than a third of the patients and, therefore, cure in the other two-thirds is less secure. The other cause for concern is the evidence for the presence of more than one tapeworm in four of their patients. Could there be more tapeworms in the gut of those who only expelled one scolex? Notwithstanding these questions, Jeri and colleagues provide a simple and important advance in the management of taeniasis.

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