The insect vector always bites twice

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The reality of the threat from vector-borne diseases has been recognized and the problem is prompting research scientists to take a strong interest. Most of these infections, classified as emerging or re-emerging diseases, are linked to ecosystem changes, climatic variations or pressure from human activities. Malaria, sleeping sickness and so on lead to the death of millions of people in the world. African countries are particularly strongly hit. The expansion of Dengue fever and the recent epidemics of Chikungunya and West Nile disease illustrate the trend.

The pathogens responsible for these diseases can be viruses, bacteria or protozoans which are passed on to humans by an arthropod vector, most often a dipteran insect. This becomes infected when it feeds, taking blood from an infected vertebrate host. The pathogenic agent finds conditions to reproduce and proliferate in the vector's body. In most cases, the parasite moves back into the vector's salivary glands in order to be transmitted to the human host when the insect bites again to take another blood meal. Morbidity among infected people is therefore associated with the degree of exposure of the subject to insect vector bites.

The vector saliva, which is adapted for blood feeds, plays a prime role in the transmission of the associated diseases. It contains numerous proteins, including immunogenic ones that can modulate or induce a human immune response. Working for the EpiVect programme initiated in 2003, scientists from IRD research unit UR 024 studied this still little known response with the aim of identifying in the arthropod vector saliva the immunogenic proteins responsible. They called on

immunological techniques to evaluate qualitatively and quantitatively, in the serum sampled from human populations living in transmission areas, the presence of antibodies targeting specifically these proteins contained in an extract of total saliva of the culprit vector.

This approach, based on the studies of malaria transmission by mosquitoes of the genus Anopheles and human African trypanosomiasis (sleeping sickness) by Glossinia species or tsetse flies, revealed that the antibody response can represent a good indicator of the degree of exposure of humans to bites, which could in the long term allow improved assessment of the risk of transmission of these diseases in a given region.

In Senegal the rate of antisalivary antibodies against Anopheles in young children (under 5 years), the population most exposed to the risk of malaria, appeared to be proportional to the actual degree of exposure, which had been assessed beforehand by standard entomological capture techniques. All the children involved in the study showed a higher level during the period of most intense transmission, in September. The antibody rate proved also to be associated with the risk of occurrence of a malarial attack in the following three months. These antisalivary antibodies consequently seem to be indicators of the risk of malaria in endemic areas, that could be used to improve strategies of prevention and care of young patients in the context of seasonal transmission of the disease.

The objective of the work conducted on human African trypanosomiasis was to analyse the antibody response to identify exactly, in total saliva extract of Glossinia flies, the immunogenic proteins responsible for synthesis of these specific antibodies. The different saliva proteins of four Glossinia species, uninfected, vectors or non-vectors, were separated then put into contact with the serum of individual subjects, infected or uninfected, exposed to bites. Comparison of salivary protein

immunogenic profiles obtained showed that they differ depending on the infection status of the subjects (exposed uninfected/infected) and the vector or non-vector status of the Glossinia. Hence, immunogenic proteins specific for two Glossinia species investigated (a 42 kDa protein in G. fuscipes fuscipes, and 50, 55, 65 and 72 kDa proteins in G. morsitans morsitans) could be used to assess specifically the degree of exposure to bites of each of these species.

Starting from immunogenic salivary proteins, simple and effective prevention tools (immuno-tests) can be devised to assess the exposure of human subjects, or be used in endemic areas to evaluate the efficacy of existing vector control strategies, such as the use of impregnated mosquito nets. Analysis of the host-vector relationship, up to now dealt with mainly from the angle of allergic responses to bites or in the search for veterinary vaccines, constitutes now an important research path for new surveillance and prevention strategies.

Source: Institut de Recherche Pour le Développement