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EMERGING AND RE-EMERGING ZOONOTIC PARASITES: PREVENTIVE AND CONTROL STRATEGIES

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Abstract: Emerging and re-emerging infections are on the rise because specific social, ecological, climatic, environmental or demographic factors contribute to the emergence of an infectious disease and the militating factors themselves are increasing, and are overtly described as numerous and interrelated. Pathogens capable of infecting more than one host, more than one taxonomic order, and pathogens infecting wild hosts, all have a higher relative risk of emergence than pathogens with a more restricted host range. Prevention and control of emerging and re-emerging zoonotic parasites remain a complex task and requires an integrative and multidisciplinary approach, molecular techniques and traditional epidemiological investigations to define the problem, as well as management strategies that will be effective for these infections. Education and behavioural changes are critical for the success of both prevention and control of these diseases.

Keywords: Emerging, Re-emerging, Zoonotic parasites, Prevention and Control.

Introduction

Parasitic diseases can broadly be divided into two classes: animal health parasitic diseases (affecting animals) and human health parasitic diseases (affecting humans). Although this division becomes unclear in case of zoonotic parasites. Emerging infectious diseases are those that have newly appeared or that had existed in the past, but are now rapidly increasing in frequency, geographical range, or both. Re-emerging diseases are infections, that have decreased in incidence in the global population, and are brought under control through effective health care policies and improved living conditions, reaching a nadir, and, more recently, begin to resurge as a health problem due to changes in the health status of a susceptible population. Emerging and re-emerging infections are on the rise because specific social, ecological, climatic, environmental or demographic factors contribute to the emergence of an infectious disease and the predisposing/militating factors themselves are increasing, and are overtly described as numerous and interrelated. There are also emerging issues related to conservation, particularly of endangered species, because of the

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problems such emerging diseases may inflict on wildlife (Daszak *et al.,* 2000). However, pathogens capable of infecting more than one host (which, for human diseases, include all zoonoses), more than one taxonomic order, and pathogens infecting wild hosts, all have a higher relative risk of emergence than pathogens with a more restricted host range.

Prevention and control of emerging zoonotic parasites remain a complex task. These parasites have higher diversity, often complex modes of transmission, and the influence of human involvement in perpetuation of their life cycles. Therefore, their prevention and control requires an integrative and multidisciplinary approach, molecular techniques and traditional epidemiological investigations to define the problem, as well as management strategies that will be effective for these infections. Reduction of parasite burden is certainly a major objective, but can't be set alone. Therefore, environmental and ecological modifications need to be implemented to reduce not only the parasitic load, but also the risk of parasite transmission. Also, education and behavioural changes are critical for the success of both prevention and control of these diseases.

Some of the important preventive and control methods as described by Chomel (2008) are here:

Climate and ecological changes

Epidemiological triad contains environment as one of its component in causing a disease. The integrated use of geographical information system (GIS), remote sensing and geostatistics, has provided new insights into the ecology and epidemiology of diseases at a variety of spatial scales (Brooker, 2007). Since environment is proposed to be one of the causal factor, the information obtained from them is increasingly used to predict spatial distributions of diseases.

The on-going global climate change has brought a change in alteration of habitats of parasites and other pathogens and they have moved to newer areas and habitats which were initially too cold to harbour these organisms. Such type of parasites have been termed as emergent parasites, resultant infection of which would make hosts vulnerable in regions which were earlier free or less affected. Climate change which in itself is an alteration in climate, could be of warming or a cooling type. A warmer climate is more significant as small increase in temperature results in modifications of both, the biotic and abiotic factors, which in turn influence the activities of vectors, parasites and their hosts in the environment. Generally, global warming enhances the development, multiplication and spread of many parasitic infections. Rising temperatures in conjunction with high stocking densities, are a

disadvantage to the hosts while an advantage to the parasites. This is because both, the free-living developmental stages of the parasites and their intermediate hosts/vectors develop and/or multiply faster at the higher optimum temperature. Temperature can also affect the multiplication and survival of an infectious agent within the vector, thereby further influencing disease transmission in areas where the vector is already present.

Truncate animal reservoirs and vectors

Reservoirs are those organisms which are naturally infected with the parasite without showing any clinical signs and symptoms of the disease, but act as a source of infection to others. Vectors are normally considered to be invertebrate animals, usually arthropods, which transmit a parasite from one animal to other, either mechanically or biologically. Integrated manoeuvres are needed to reduce the density of animal reservoirs as well as vectors. Vector control is the primary means of preventing vector-borne diseases, which depends on the temperature, humidity and other environmental factors. Habitat modification, a mainstay of vector control of early 20^{th} century public health, was replaced by chemical methods when they became relatively inexpensive and widely available. Pesticides remain the primary means to mitigate most vector-borne diseases, but resistance has increasingly limited the effectiveness of this strategy. As insecticide resistance poses a significant barrier in controlling vector-borne diseases, the development of novel insecticides is of foremost importance.

Reduction of worm burden

For effectively controlling emerging parasitic zoonoses, decrease in the presence of parasites or their eggs in the environment is cardinal. Prudent measures for preventing animal and human infection include animal owner education and regular deworming of animals. Education of owners needs to be focussed on prevention, and should include personal hygiene, disposing animal faeces regularly to reduce environmental contamination, and minimizing exposure of children to potentially contaminated environments. Because puppies, kittens, pregnant and nursing animals, and hunting dogs are at the highest risk of roundworm or tapeworm infection and are therefore, responsible for most environmental contamination and human disease; anthelminthic treatments are most effective when they are initiated early and target these animal populations.

International concordance

“One Health” strategy has recently been developed to expand interdisciplinary collaborations and communications on all aspects of health care for humans, animals and the

environment. The involvement of international agencies and institutions, such as World Health Organization (WHO), Food and Agriculture Organization (FAO), Office International des Epizooties (OIE) and International Livestock Research Institute (ILRI), as well as the fidelity of policymakers, scientists and field veterinarians, are key means for the sustainable control and prevention of parasitic zoonoses and, probably, the eradication of some of them. Also, multisectoral articulation for disease containment, independence of sectorial interests and transparency are critical when managing certain health risks, as mentioned by the WHO (Meslin *et al*., 2000). This interagency network provides a basic framework for the dissemination of information related to the diagnosis, prevention and control of major zoonotic diseases, including emerging or re-emerging parasitic zoonoses.

Human deportment, tutelage and edification

Educating people may bring some change in human behaviour, although it is regarded as an utterly difficult task. Public health professionals play a pivotal role in public education about zoonotic diseases, and medical community depends upon veterinary profession for education of the public about zoonoses. As indicated by Grant and Olsen (1999) ‘‘Physicians believe that veterinarians should be involved in many aspects of zoonotic disease prevention, including patient education”.

Improved diagnostic tools and broader use of diagnostic tests

Revamped methods for detection of parasites in animals, humans and in the environment are considered to play a critical role in proposing and implementing control measures. It will help in both, prevention as well as control of zoonotic diseases. Immunodiagnostic tools are helpful in screening of the population, and to be combined with conventional methods for confirmation.

Kosher financial resources and public health structures

Pertinent financial resources need to be granted to endure programs that will reduce the risk of human and animal infestations. Due to lack of financial assistance, programs can’t be implemented. Uncontrolled urbanisation, especially in many tropical areas, where parasitic burden is heaviest, brings its own constraints and limitations for implementation of control programs. Some diseases are being transmitted in urban areas, due to the emergence or re-emergence of their vectors, such as Dengue, Malaria and Visceral Leishmaniasis. Difficulties in control occur, as it is often easier to apply control measures in rural areas, because there is more population compliance and adherence to parasitic control programs than in urban areas. Therefore, the coverage is higher and disease control is better in rural settings. The WHO

encourages governments to integrate disease control programs with primary health care. Integrated approaches include less dependence on pesticides; encouraging changes in human behaviour; disseminating health messages; community participation, particularly youth; mobilization of human and financial resources; and proper urban development, e.g., better quality housing, adequate sanitation and drinkable water (Knudsen and Slooff, 1992).

Conclusion

Despite advances in our understanding of the biology of helminth parasites, zoonotic helminth infections remain endemic in many parts of the World, and emerging and re-emerging zoonotic parasites are now becoming the greatest threat to life. Most zoonotic infections can be prevented through biosecurity, good farm management, personal hygiene and food preparation practices. However, large-scale drug treatment of infected humans and animals together with widespread public education programmes, is also likely to decrease infection rates, especially in developing countries. According to the World Organization for Animal Health (OIE), 75% of the emerging diseases originate from domestic or wild animals, which prompts for a close collaboration between animal and public health authorities.

Among the mechanisms which promote the emergence of some parasitic diseases in human pathology, are unbalanced host-parasite relationships, the continued disturbance of natural ecosystems by destructive changes in land use, especially deforestation, and poor husbanding of natural resources resulting in modified distribution and behaviour of parasites, their hosts and vectors especially under the influence of major immunodeficiencies—have probably played an essential role. These host-parasite relationships are both, the result and the cause of these emergent diseases. Improved surveillance and monitoring is needed so as to detect changes resulting from global climate and ecological change, both for identification of immediately required action and to serve as the basis for developing predictive models. Such models provide insight into associations among ecological factors, entomological, genetic and behavioural characteristics of vectors and parasites, and human behaviour that are associated with disease transmission. Multidisciplinary co-operation among workers in public health, ecology, and the social and physical sciences holds out the best hope for developing comprehensive risk assessment to aid local, national and international governments and decision makers.

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