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Original Article

Getting dengue from vector mosquito bite at home: a reappraisal on chance based on molecular epidemiology data in Indochina

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Abstract: Dengue is an important vector borne viral infection. At present, it is endemic in many tropical countries. A molecular epidemiology of viral type in patients and mosquitoes can give useful epidemiology data for disease control. In Indochina, dengue is very common and the molecular epidemiology surveillance is continuously performed. Here, the authors reappraise on available local data from epidemiology studies of viral type in patients and mosquitoes in an endemic area of dengue in Indochina. According to analysis, the authors found that a considerable number of dengue patients do not have the same viral type with caught mosquito vector at their home. According to this study, a chance that a dengue patient gets pathogen from mosquito bite at home is 2.185%. The chance of getting dengue from the vector mosquito bite at home is not high. Hence, a public health policy to control of mosquito vector at home has to extend to universal control at any public places.

Keywords: Dengue, mosquito, type, molecular

Introduction

Dengue is an important vector borne viral infection caused by an arbovirus, dengue virus. This disease can cause febrile illness and there might be a deadly hemorrhagic complication and shock in severe infection [1]. At present, dengue is endemic in many tropical countries. A molecular epidemiology of viral type in patients and mosquitoes can provide useful epidemiology data for appropriate control of dengue. In Indochina, dengue is very common and causes a high morbidity/mortality each year [2].

At present, the molecular epidemiology surveillance is performed in this area [3]. Here, the authors reappraise on available local data from epidemiology surveys of viral type in patients and mosquitoes in an endemic area of dengue in Indochina.

Materials and methods

This is a retrospective study on primary available public data. The work is not a study in human, animal or clinical sample and required no ethical approval. Primary data from molecular epidemiology surveillance in a tropical country, Thailand are reappraised [4]. The survey area is the highly endemic area of dengue. The aim of this study is to reappraise on chance of a person to get dengue from the vector mosquito bite at home. Regarding molecular epidemiology surveillance, the 3 year (2016-2018) data are derived [4]. Regarding molecular epidemiology laboratory test, both dengue suspicious patients and mosquito vectors caused from their houses are investigated 292 human dengue cases and 902 mosquito vectors [4]. Serotyping studies were carried out. For human blood samples, viral detection and serotyping were performed using RRT-PCR according to standard protocol proposed by Shu et al [5]. For mosquito vector samples, protocol for typing is detailed in the previous study [4].

A reappraisal to estimate the concordant rate between detected viral type in human and mosquito is done. Additionally, the chance that a dengue in a patient is from a mosquito bite at

Table 1. Calculated chance of getting a dengue from mosquito bite at home*

Dengue type	Possibility		Chance (%)
	dengue positive mosquito	matched type of dengue in mosquito sample	
Any dengue type	0.1608	0.1359	2.185
DEN 1	0.0145	0.1359	0.198
DEN 2	0.0614	0.1359	0.834
DEN 3	0.0799	0.1359	1.085
DEN 4	0.0080	0.1359	0.110

*chance of getting a dengue from mosquito bite at home is calculated by "probability of dengue positive mosquito bite x probability of matched type of dengue in mosquito sample".

his/her house is calculated. In order to calculate, the basic mathematical principle of joint probability is used. Conceptually, there are two main components to contract dengue fever. Conceptually, there must be the mosquito vector carrying the pathogenic virus and the patient must be bitten then get virus. With a primary assumption that a patient got mosquito bite at home, contracting dengue fever is possible only if there is the matching of type of dengue in both patient and mosquito. For calculation, chance of getting a dengue from mosquito bite at home will be equal to "probability of dengue positive mosquito bite x probability of matched type of dengue in mosquito sample". Regarding primary parameters for overall dengue type, probability of dengue positive mosquito bite is equal to "number of dengue positive mosquitoes/number of overall genotyped mosquitoes" and probability of matched type of dengue in mosquito sample is equal to "number of mosquitoes with matched genotypes with humans/number of overall genotyped mosquitoes". In case of specific calculation for each dengue type, the proportion factor of each dengue type (number of mosquitoes with that dengue type/summative number of mosquitoes from all 4 types) is applied to adjust probability of dengue positive mosquito bite to get type specific probability of dengue positive mosquito bite.

Results

From the overall laboratory analysis, there are dengue positive 103 human blood samples and 145 mosquito vector samples. From molecular typing, the DEN 1, 2, 3 and 4 are detected in 27, 25, 40 and 38 cases of those 103 positive human blood samples and in 18, 72, 99 and 10 cases of those 145 positive mosquito vector samples. Some samples have more than 1 dengue type (summative number of all types is equal to 199, more than number of positive mosquito vector samples). Regarding type matching, only 14 from all 103 positive human blood samples have the matched same type in collected mosquito samples from home.

For overall mosquitoes, probability of dengue positive mosquito bite is equal to and probability of matched type of dengue in mosquito sample is equal to 0.1608 (103/145) and 0.1359 (14/15), respectively. Hence, matched type of dengue in mosquito sample is equal to 0.1359. For each dengue type, the proportion factors of DEN 1, 2, 3 and 4 are equal to 0.090, 0.362, 0.497 and 0. 0.050, respectively. Therefore, a calculated chance of getting a dengue from mosquito bite at home is presented in **Table 1**.

Discussion

Dengue is an important tropical arboviral infection. Outbreak of dengue occurs in each year in several tropical countries, including to tropical Asian countries [2]. Molecular typing of dengue is useful for getting epidemiological data for planning for management of outbreak [6]. Since it is a vector borne disease, combine molecular epidemiology study in both human and vector can give a useful data [7].

Based on the present study, only few mosquitoes caught from homes of dengue patients are positive for dengue virus and when further molecular typing is done, there are very few matching of viral type. This might imply that the dengue virus might circulate widely in mosquito in endemic area and there are many human infections. In general, control of mosquito is the

main prevention against dengue [8]. In endemic area, routine public health promotion for controlling mosquito and its larva in houses is performed regularly. However, in the present study, it clearly shows that the change of a person to get dengue from mosquito bite at home is low. This is concordant with a recent report that most dengue cases get virus from visiting other places away from their homes [9]. Nevertheless, mosquitoes are flying around and they travel frequently, so the mosquito typing in a dengue patient's home might not really representative. Also, there is a possibility of false negatives. Present experimental data are cannot still lead to the final conclusion.

This report might give an additional recommendation that a self-prevention against mosquito bite is necessary regardless of places. Also, vector control and molecular surveillance of mosquito vector ate public place where a proper mosquito control might not be intensive as the house is needed. Examples of useful preventive measures are regular application of larvicidal agent into the public water resources and application of insecticide at public places.

Conclusion

According to the present study, a considerable number of dengue cases do not have the concordant viral type with caught mosquito vector at their home. Therefore, the chance of getting dengue infection from the vector mosquito bite at home is not high in this area. An adjustment of public health policy from focused control of mosquito vector at home to extended universal mosquito control at any public places is recommended.

Disclosure of conflict of interest

None.

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