A Field Study on Malaria Prevalence along the Myanmar Thailand Border by Rapid Diagnostic Test (RDT) and Polymerase Chain Reaction Assay (PCR)

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Authors' contributions

This work was carried out in collaboration between all authors. Author SC designed the study, wrote the protocol and wrote the first draft of the manuscript. Author YP managed the literature searches, analyses of the study performed the statistic analysis and author WN managed the experimental process and identified the species of Malara parasite. All authors read and approved the final manuscript.

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ABSTRACT

Background: Thailand has a national goal to eliminate malaria from 80 percent of the country by 2020. An accurate detection and prevalence are critical to effective management of malaria. Rapid diagnostic tests (RDTs) detecting parasites lactate dehydrogenase (pLHD) antigen are used to identify individuals with Plasmodium falciparum infection even in low transmission settings seeking to achieve elimination.

Aims: The aim of this study was to evaluate the exact prevalence of malaria in the Thai border area where malaria is endemic by RDT compared with PCR.

Methodology: One thousand one hundred thirty blood samples were obtained from study subjects who live along the Myanmar Thailand Border. RDT was performed with the parasite lactate

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dehydrogenase (pLDH) antigen-based lateral flow test and the primer set used for PCR was designed on the species-specific nucleotide sequence of 18S rRNA plasmodium gene.

Results: Malaria infection was demonstrated in 70 (6.2%) subjects and 87 (8.8%) subjects by RDT and PCR respectively. PCR detected a significantly higher number of malaria infection than RDT (P<0.05). Comparison of RDT negative and PCR positive samples suggested that RDT negatives resulted from low parasitaemia. Moreover, PCR was able to identify the species of Plasmodium parasite. Three species, Plasmodium falciparum, Plasmodium vivax and Plasmodium malariae were detected. No Plasmodium ovale was detected from any of the study location. P. falciparum was predominant along border with a percentage of 31.9 of positive suspected patients. Mixed infections with two or three malaria species were detected in 54 specimens (55.7%).

Conclusion: The result demonstrates that PCR should be undertaken to assess the prevalence of malaria in border areas to progress towards malaria elimination in Thailand.

Keywords: Malaria; prevalence; rapid diagnostic test; polymerase chain reaction assay.

1. INTRODUCTION

Malaria is a life threatening parasitic disease transmitted by Anopheles mosquitoes. It is the most highly prevalent tropical disease, with economic and social impact. In Southeast Asia, the number of malaria cases has been grossly underestimated [1,2]. The largest focus of falciparum malaria in this region is situated in Myanmar, with a reported annual caseload of 70,941 in 2010 [3]. In that same time period, Thailand had about 70 percent decreased in reported malaria cases between 2000 and 2011, from 78,561 cases to 24,897 cases. According to Thai government increased funding for malaria control, overall incidence declined [4,5]. Central Thailand has been malaria-free for more than three decades. However, malaria endemic areas are still located along the forested border. Malaria in Thailand is forest related, with high prevalence along the densely forested border areas [6,7]. The border between Thailand and Myanmar is 2,107 km long and is mostly forested and mountainous. It is inhabited by a mosaic of ethnic groups and is characterized by intense migration fluxes between the two countries. Malaria control in this border area is particularly challenging, because of a reservoir of malaria in Myanmar, where the disease burden is higher than in Thailand and differences in adequate control measures on the two sides of the border. In addition, decades of internal conflicts and economic impact in Myanmar have resulted in massive population displacement, and over 150,000 refugees have allowed continued malaria transmission in Thailand [8]. The Thai government has organized a nationwide anti-malaria network consisting of malaria centers in each district, proper treatment of malaria cases and improvement of diagnostic facilities [5]. Current malaria control activities in Thailand are also supported by the Mekong Malaria program (MMP) and Global Funds [9,10]. These grants aim at eliminating and combating artemisinin resistance in the Mekong region [11]. Thailand is pursuing spatially progressive elimination and has a national goal to eliminate malaria from 80 percent of the country by 2020 [6].

Improving diagnostic accuracy in malaria control and elimination must be technically challenging. Since the WHO recognized the diagnostic tool for simple, quick and cost-effective tests for determining the presence of malaria parasites, numerous rapid diagnostic tests (RDT) have been developed. The use of RDTs provides the most feasible means of rapidly expanding diagnostic testing, especially in peripheral health facilities. The test kit is simple to use. Following WHO recommendation of using RDT in all suspected malaria cases, they are widely applied in regional clinics in endemic areas. They can be performed by a health worker [12,13]. In Thailand, the rapid diagnostic tests (RDTs) such as Immunochromatographic test (ICT), that are based on the recognition of Plasmodium antigen in the blood circulation of patient, have been used in diagnosing and determining malaria prevalence. RDTs were implemented in the management of febrile illnesses in remote malaria endemic areas. It was supported by a global Fund [10]. Most ICT products are suitable for diagnosis of P. falciparum and P. vivax malaria [14]. Recently, the interpretation of malaria diagnosis and epidemiology have been changed by molecular tools, for instance by revealing grand reservoirs of asymptomatic infection and by detecting distribution of Plasmodium spp. infection. According to DNA amplification, all species could be identified [15]. The current study compared the performance of RDT with PCR for assessment of true malaria