Congenital Genetic Hemoglobin Disorder and the Resistance to Tropical Blood Infection: An Important Phenomenon in Indochina

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Introduction

Dear Editor, the congenital hemoglobin disorder is a common group of genetic disorder seen worldwide. In tropical Asia, it is also an important cause of tropical anemia [1]. The common genetic hemoglobin disorder in Indochina, tropical area in Southeast Asia, includes hemoglobin E and beta-thalassemia [2]. Of interest, the relationship between hemoglobinopathy and blood infection such as malaria is proposed in the literature [3]. The sickle cell anemia is proved to have resistance to malaria and this is believed to be a natural selection process [4]. Here, the authors would like to additional discuss on the hemoglobin E, the specific common and high prevalence congenital genetic hemoglobin disorder in Indochina. It is estimated that one-third of the local people in this endemic area contain the abnormal gene and becomes carrier of disease. The screening for the genetic disorder becomes important local public health policies [5].

Regarding the interrelationship between hemoglobin E and the common endemic blood infection in this area, there are few reports. In fact, similar to hemoglobin S, the hemoglobin E should have resistance to the blood infection especially for malaria [6]. Hutagalung, et al. reported that “hemoglobin E trait may ameliorate the course of acute falciparum malaria” [6]. Also, a high prevalence of hemoglobin E is usually seen in the area with high prevalence of malaria [7]. Keusap, et al. found that “parasitemia with coexistence of Hb E were 2 times lower than those with coexistence of thalassemia other than hemoglobin E” [8]. Nevertheless, some reports present the opposite finding [9]. Focusing on the underlying mechanism contributing to resistance, it is still unknown. Lachant NA, et al. proposed that “impaired antioxidant defense may account for the persistence of the hemoglobin E gene in areas where malaria is endemic” [10]. Indeed, the mechanism of infection might be explained by the aberration of the red blood cell shape and the red cell membrane. In hemoglobin E, the microcytic appearance with target shape aberration is the significant phenotype. Based on biophysics, he estimated cell surface area of hemoglobin E red cell is about 2/3 of normal red cell. This can simple explain the biophysical mechanism underlying the resistance to blood pathogen. Decreased cell surface area means the reduced target for pathogen attachment; hence, it means reduced change of getting infection. Indeed, the red cell shape change in hemoglobin disorder has been proved for a long time for the relationship to red cell elasticity and membrane reaction to stress [11]. For the case of hemoglobin E, the reduction in diameter can simply imply the reduced available membrane area that can be attached by any infective pathogens.

However, the reduced chance should be less than the case of sickle cell in hemoglobin S disorder, which has more reduced cell surface area. Hence, the carrier stage of hemoglobin E in Indochina might be classified as a useful genetic variant. This variant might pose some anemic problem but it can be a useful tool against the...
common tropical infection in this area. In additional to hemoglobin E, the similar phenomenon can also be seen in other uncommon hemoglobinopathy seen in this area [12] and the explanation might also be by the biophysical aspect of the aberrant red blood cell.

Conflict of Interest

None.

References

1. Wiwanitkit V. Tropical Anemia. 2007; Nova Publisher.