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■ Case report ■

# A case of *Plasmodium vivax* malaria occurring during a school excursion to Pocheon-gun

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= Abstract =

Malaria caused by *Plasmodium* species is characterized by paroxysms of fever, chills, fatigue, anemia, and splenomegaly. *Vivax* malaria has lately re-emerged as an infectious disease and has exhibited high transmission rate in northern Gyeonggi-do province. We encountered a case of malaria in a child presenting with fever and thrombocytopenia who had recently made a school excursion to Pocheon-gun, Gyeonggi-do. The child was diagnosed with *Plasmodium vivax* malaria and treated with hydroxychloroquine and primaquine. Here, we present this case with a brief review of the literature. (Korean J Pediatr 2010;53:85-88)

Key Words : Malaria, *Plasmodium vivax*, Fever, Thrombocytopenia, School excursion

## Introduction

Malaria is of overwhelming importance worldwide, with an estimated 300-500 million cases and 1-2 million deaths each year[1, 2]. In Korea, *Vivax* malaria has been reemerged since 1993, after then increased abruptly year by year[3]. The majority of the patients were military personnel who served near the demilitarized zone (DMZ), the part of Gyeonggi-do and northwestern part of Gangwon-do. However an apparent tendency was noted that the proportion of civilian and children cases increased. The number of malaria cases occurred in children increased also[4-7]. But most of all reported cases were inhabitants or long-term visitors of the endemic areas. We experienced a child presenting fever, thrombocytopenia who had made a school excursion to Pocheon-gun, Gyeonggi-do. He was diagnosed *Plasmodium vivax* (*P. vivax*) malaria and treated with hydrochloroquine and primaquine.

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## Case report

A 12-year-old boy was admitted to our hospital and presented with periodic fever, chill, abdominal discomfort. He had made a school excursion to Pocheon-gun, 7 days prior to admission. He was born at full-term of gestational age and lived in Seongdong-gu, Seoul. He had never been abroad and no history of transfusion, drug abuse. His body temperature was 39.1℃, heart rate was 91 beats/minute, blood pressure was 110/57 mmHg, and respiratory rate was 20 beats/minute. Physical examination revealed petechiae on both lower legs. Mild splenomagaly and hepatomegaly was examined. The laboratory findings at admission day were hemoglobin (Hb) 13.5 g/dL, hematocrit (Hct) 38.5 %, white blood cell (WBC) 1,890/mm$^3$ (lymphocyte 37%, neutrophil 58%), platelet 42,000/mm$^3$. The blood chemistry showed aspartate aminotransferase (AST)/alanine transaminase (ALT) 65/117 IU/L and C-reactive protein (CRP) 2.43 mg/dL. On malaria polymerase chain reaction (PCR), *P. vivax* was positive and *Plasmodium falciparum* (*P. falciparum*) was negative. *P. vivax* trophozoites, gametocytes and schizonts were observed on peripheral blood smear (infection rate per red blood cell (RBC) was 0.14%). Cultures of blood, urine and stool were negative. The chest x-ray did not show any abnormality. The abdominal ultrasonography revealed mild hepatosplenomegaly (spleen size 11.9 cm). The patient was treated with hydroxychloro-

quine (10 mg/kg, 5 mg/kg at 6 hours, 24 hours, and 48 hours. A total to 25 mg/kg) for 3 days with an additional antimalarial drug, primaquine (15 mg/day) for 14 days. At admission day 2, the laboratory findings were Hb 12.9 g/dL, Hct 36%, WBC 3,800/$mm^3$ (lymphocyte 49%, neutrophil 44%), platelet 38,000/$mm^3$. Fever and abdominal discomfort were improved. He was discharged after 5 days with significant improvement of thrombocytopenia and malaria infection rate on peripheral blood smear. The laboratory data were as follows: Hb 12.2 g/dL, Hct 35.2%, WBC 5,350/$mm^3$ (lymphocyte 65.2%, neutrophil 20.4%), platelet 238,000/$mm^3$. 2 parasites were observed on peripheral blood smear (infection rate per RBC was 0.14%). Follow-up peripheral blood smear showed no parasite.

## Discussion

Malaria caused by Plasmodium species is an acute and chronic illness characterized by paroxysms of fever, chill, fatigue, anemia, and splenomegaly. Vivax malaria reemerged recently and showed high transmission rate in northern Gyeonggi-do province. *Plasmodium vivax* (*P. vivax*), *Plasmodium falciparum* (*P. falciparum*), *Plasmodium ovale* (*P. ovale*), *Plasmodium malariae* (*P. malariae*) can cause human infection[1, 2]. It is generally accepted that *P. vivax* is the only indigenous species which had been the predominant species in the past and reemerged recently in Korea[3, 5]. Vivax malaria has been eradicated for a few decades through persistent national health program and nutritional improvement. However it has been reemerged among military personnel near Gyeonggi-do and Gangwon-do since 1993[3-5]. Possible reasons and vectors of the reemergence of malaria were the mosquitoes flown from the North Korea. But recently substantial number of patients occurred in remote from the major outbreak areas even in Seoul. It concerns reemerging malaria to settle and become endemic[4-8].

Malaria is transmitted by the bite of infected *Anopheles* mosquitoes. Sporozoites inoculate into the bloodstream by a female *Anopheles* mosquitoes, and enter the hepatocytes where they develop and multiply as a schizonts. After 1-2 weeks the hepatocytes rupture and release thousands of merozoites, which then invade red blood cells (RBCs), *P. vivax* and *P. ovale* have a second type of exoerythrocytic form, the hypnozoite which remains dormant in the liver. They may develop weeks to years later into merozoites and thereby causing relapses of infection. Inside the erythrocyte, the merozoite transforms into the ring form, trophozoite, erythrocytic merozoite that is released into the bloodstream when the erythrocyte membrane ruptures, which is associated with fever. Some of the merozoites develop into male and female gametocytes which are then

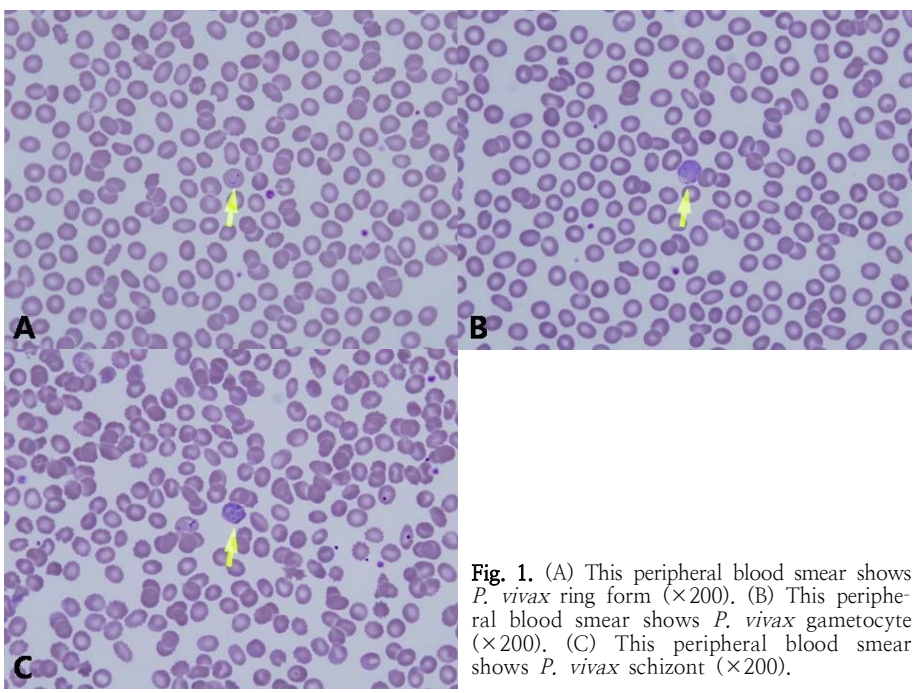


**Fig. 1.** (A) This peripheral blood smear shows *P. vivax* ring form (×200). (B) This peripheral blood smear shows *P. vivax* gametocyte (×200). (C) This peripheral blood smear shows *P. vivax* schizont (×200).

available for ingestion by mosquitoes to complete the life cycle within the mosquitoes[1, 2].

The incubation periods are *P. falciparum*, 9-14 days; *P. vivax*, 12-17 days; *P. ovale*, 16-18 days; and *P. malariae* 18-40 days. The classic presentation of malaria consists of paroxysms of fever (coincide with the rupture of schizonts that occurs every 48 hours with *P. vivax* and *P. ovale*, every 72 hours with *P. malariae*), anemia, thrombocytopenia, leukopenia, splenomegaly, or any combination of these manifestations. Fever is caused by the rupture of schizonts, stimulation of glycosyl phosphatidyl inositol anchor which link the membranes of erythrocytes and parasite proteins, stimulation of cytokines (tumor necrosis factor alpha (TNF-α) and vasoactive kinin) by macrophages[14]. Anemia may develop as a result of destruction of RBCs, impaired erythropoiesis by TNF-α and glycosyl phosphatidyl inositol. Thrombocytopenia is caused by production of immunoglobulin-G (IgG) antiplatelet antibodies which coated with parasitic antigens and antibody-mediated splenic sequestration. Recent studies reported that thrombocytopenia is associated with decreased number of macrophage colony-stimulating factor (M-CSF), the hematopoietic factor, and P-selectin[10, 15]. Lim et al.[11] reported that unless treated, thrombocytopenia might be observed in 70-100% patients. Therefore platelet counts in malaria patients could be used as a marker for post-treatment follow-up[5, 9].

The most important first step in the diagnosis of malaria is to consider the diagnosis in individuals with febrile illness, especially those with a history of travel to endemic areas. And then the diagnosis is established by identification of organisms on smear of peripheral blood[1, 2, 4, 12]. Thick smears have great sensitivity to determine positive or negative as a result of the larger quantity of blood used. Thin smear allows for positive identification of the malaria species and determination of the percentage of infected erythrocytes[4, 13].

Treatment of malaria depends on identification of species of *Plasmodium* causing infection, the presence of resistance to chloroquine in the local area, and the therapeutic goal. Drugs in use for treating malaria include chloroquine, primaquine, quinidine gluconate, mefloquine, quinine sulfate. Patients with indigenous *P. vivax* malaria should be given chloroquine phosphate or hydroxychloroquine (10 mg/kg, 5 mg/kg at 6 hours, 24 hours, and 48 hours. A total to 25 mg/kg) with an additional antimalarial drug primaquine for 2 weeks to eradiated hypnozoites. There is no reported case with chloroquine resistance indigenous vivax malaria in Korea.

The uncommon occurrence of asymptomatic latent infection, less severe symptoms are clinical characteristics of the reemerging *P. vivax* malaria in Korea. Therefore physicians should consider the diagnosis of malaria in any febrile child accompanying thrombocytopenia, anemia, and splenomegaly[5, 6, 8]. Prevention of malaria can be accomplished by reduction of the mosquito population and use of personal protection methods to avoid exposure[2]. When children or adolescents travel to endemic areas, they should remain in well-screened areas from dusk to dawn, sleep under permethrin-treated mosquito netting and spray insecticides, wear clothing that covers the arms and legs, with trousers tucked into shoes or boots[1]. We experienced a case of malaria in a child presenting fever, thrombocytopenia who had made a school excursion to endemic area. He was diagnosed *P. vivax* malaria and treated with hydroxychloroquine and primaquine. We present this case with a brief review of the literature[1, 2, 5, 6, 10].

## 요 약

### 수학여행 후 발생한 *Plasmodium vivax* 말라리아 1례

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**곽병옥 · 정소정 · 김교순**

말라리아는 *Plasmodium* species의 감염에 의해 생기는 주기적인 발열, 오한, 피로, 빈혈, 비종대를 특징으로 하는 질병이다. 과거 국내에 크게 유행하였던 삼일열 말라리아는 최근 경기도 북부 지역을 중심으로 재유행하고 있고 높은 전염률을 보인다. 저자들은 경기도 포천으로 수학여행을 다녀온 후 고열과 혈소판감소증이 발생한 말라리아 1례를 경험하였다. 환아는 삼일열 말라리아로 진단되어 hydroxychloroquine, primaquine으로 치료받았다. 이에 저자들은 문헌 고찰과 함께 보고하는 바이다.

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