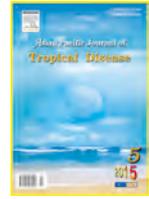


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## Mixed infection of *Plasmodium falciparum* and *Plasmodium vivax* and unusual presentations of vivax malaria in the Andaman Islands-case reports

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### PEER REVIEW

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#### Comments

Malaria is a life-threatening disease which contributes to significant morbidity and mortality, especially in developing countries. As a cases report, this manuscript is interesting for malaria research and travel health community.  
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### ABSTRACT

Malaria is a life-threatening disease which contributes to significant morbidity and mortality, especially in developing countries. We report here two cases, mixed malaria and vivax malaria with unusual presentation of gastroenteritis. Two male patients aged 42 years old and a female patient aged 15 years old were admitted to hospital with fever. The patients both had symptoms of fever, chills, rigor, headache and vomiting. First patient peripheral blood smear revealed *Plasmodium falciparum* and *Plasmodium vivax* and second patient blood smear examined *Plasmodium vivax*. To our knowledge, this is the first report of vivax malaria with unusual presentation of gastroenteritis in this island and mixed malaria infection is not uncommon, and it needs to be diagnosed and treated effectively in order to control the disease.

### KEYWORDS

Gastroenteritis, Malaria, Mixed infection

## 1. Introduction

Malaria is a life-threatening disease caused by the *Plasmodium* spp. parasites and transmitted to people through the bites of infected mosquitoes. The World Health Organization has reported an annual incidence of 247 million cases and malarial mortality of one million per year[1]. In human, it is caused by five different *Plasmodium* spp., viz, *Plasmodium falciparum* (*P. falciparum*), *Plasmodium vivax* (*P. vivax*), *Plasmodium ovale*, *Plasmodium malariae*, and the new species *Plasmodium knowlesi*. With proper treatment, malaria can be controlled and steps can be taken to

eradicate this infection[2]. Earlier studies strongly suggest the occurrence of mixed infection in patients affected by malaria. The symptoms of malaria are non-specific. A significant number of patients with malaria in endemic areas may present with atypical clinical manifestations, thereby mimicking other illnesses, and leading to diagnostic confusion as well as delay in treatment[3]. This may lead to complications or even death. Complicated malaria may closely mimic other commonly prevalent infections like enteric fever, leptospirosis, dengue haemorrhagic fever, acute viral hepatitis and scrub typhus of obscure origin[4].

In this report, we described two cases of severe malaria caused

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by *P. falciparum* and *P. vivax* and another one acute gastroenteritis with *P. vivax* in the Andaman and Nicobar Islands.

## 2. Case presentation

### 2.1. Case 1

A 42 years old male patient was admitted to Gobind Ballab Pant Hospital, Port Blair (Andaman and Nicobar Islands), with history of fever, chills, rigor, headache, vomiting and malaise for previous 3 days. Prior to the onset of illness, the patient had travelled to Katchal (Nancrowy groups of islands). He complained about dark urine, hematuria and diarrhoea. He had no history of receiving prophylactic antimalarial drugs.

On examination, the patient was conscious, and the hemoglobin was 11.5 g/dL, hematocrit 35%, white blood cell count 14000/mm<sup>3</sup>, and platelet count was 35000/mm<sup>3</sup>. His blood urea was 20 mg/dL, serum glucose was 90 mg/dL, serum creatinine was 1.8 mg/dL and serum bilirubin was 0.4 mg/dL. The liver function test showed serum glutamic oxaloacetic transaminase-68 IU, serum glutamic pyruvic transaminase-45 IU and total bilirubin-15 mg/dL, circulatory collapse, and systolic blood pressure<80 mmHg. Calcium, phosphate and electrolyte levels in serum were within normal limits.

Peripheral blood smear was found with both *P. falciparum* and *P. vivax*, and 85% of red blood cells contained *P. falciparum* (1-3/red blood cell) and *P. vivax* (2-3/red blood cell). He was provisionally diagnosed for affliction with leptospirosis or dengue. Both tests were negative. Laboratory screening for leptospirosis by microscopic agglutination test, dengue by immunoglobulin M capture ELISA, stool and blood cultures was carried out at Regional Medical Research Centre, Port Blair. He was treated with doxycycline of 100 mg and 200 mg of artesunate intravenously, with a dose of 2.4 mg/kg at 12 and 24 h, then on subsequent days. The treatment was continued for 7 d and primaquine was administered on the third day, at 30 mg/d for the next two weeks. Peripheral blood smear was examined for the malarial parasite at 3, 7, 14, and 28 d, and the results were negative after the seventh day of treatment. Following seven days of treatment, the patient's symptom had resolved and was discharged on Day 8 after admission.

### 2.2. Case 2

A 15 years old female patient was admitted to Gobind Ballab Pant Hospital, Port Blair with complaints of vomiting (3-4 episodes/day), and more than eight episodes of loose watery stools with blood and mucus with abdominal cramp. She did not have a history

of recent travel and none of her family members had reported diarrhoea episodes in the recent past. The patient was administered with intravenous fluids and metronidazole infusion (75 mg), but the response was poor. Patient developed high grade fever with chills on Day 4 after admission, but the frequency of vomiting and stool were reduced.

On examination, laboratory evaluation revealed hemoglobin level to be 12.5 g/dL, leucocytes 6900/ $\mu$ L, and platelet count 37000/ $\mu$ L. The liver function test (blood urea nitrogen, serum glutamic-oxaloacetic transaminase, serum glutamic pyruvic transaminase, serum glucose and bilirubin) was normal, but serum sodium was 131.26 mmol/L and potassium was 3.19 mmol/L. Examination of peripheral blood smear showed trophozoites of *P. vivax*. Stool culture did not isolate any pathogenic bacteria of significance, and the blood culture was germ-free. Ultrasonography of the abdomen was normal. She was treated with oral chloroquine (25 mg/kg for 3 d) and the gastrointestinal discomfort subsided completely after 1 week. She was advised to take primaquine (15 mg/d for 2 week). With this medication, the patient condition improved and she was discharged on Day 8 after admission.

## 3. Discussion

Andaman and Nicobar Islands, an archipelago of more than 500 islands situated in the Bay of Bengal about 1200 km southeast of peninsular India (92–9489 E; 6–1489 N), is a Union Territory of India. This is a case report with presentation of mixed infection of *P. falciparum* and *P. vivax* and unusual presentation *P. vivax*. Malaria is one of the most important parasitic infections throughout the world, and it results in high mortality rates. Mixed infection of *P. falciparum* and *P. vivax* is not uncommon, but *P. falciparum* with *Plasmodium malariae* is rare[5,2]. Due to the widespread dissemination of *P. falciparum* and *P. vivax*, they are defined as coinfections, and are the most common causes. These coinfections, even with the right diagnosis, can result in a recurrence after treatment[6].

During the past, malaria situation in Nicobar group of islands is worse in comparison with Andaman group of islands[7]. The tropical climate prevailing throughout the year provides ideal environment for mosquito proliferation and breeding in Nicobar group of islands. Entire land mass in the islands has a network of creeks which results in an ideal brackish water habitats for the breeding of *Anopheles sundaicus*, the predominant vector of malaria in these islands[7].

The Andaman and Nicobar Islands are visited by tourists all year round from other parts of the world. Mixed malaria infections are not uncommon, and it is important that they are diagnosed

and treated appropriately, in order to control the disease. We recommend that travel consultations should be provided to all travelers before their departure to endemic areas. Till date, there are no reports of unusual presentations malaria with gastroenteritis and *P. vivax* in these remote islands and this is perhaps the first of its occurrence. The emergence of this mixed infection of *P. falciparum* and *P. vivax* is a public health concern in these remote islands. This infection can possibly change the clinical spectrum of the disease, and affect the treatment regimen. Investigation of epidemiological and immunological aspects of patients with concurrent infection is worth pursuing. To conclude, *P. vivax* malaria can rarely present with atypical gastrointestinal manifestations and mixed malaria infection, which the treating physician needs to be aware.

### Conflict of interest statement

We declare that we have no conflict of interest.

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### Comments

#### Background

Malaria is a very important parasitic disease and is also one of major public health questions. Rapid and correct diagnosis of malaria is crucial for both treatment and control of the disease. The endemic information of malaria in resort areas were concerned, especially in islands, where is a special closed environment. There were a few researches on eliminating the disease in such environment settings. Diagnosis and treatment are important aspects for elimination of malaria.

#### Research frontiers

The emergence of this mixed infection of *P. falciparum* and *P. vivax* is a public health concern in these remote islands. This infection can possibly change the clinical spectrum of the disease, and affect the treatment regimen.

#### Related reports

During the past, malaria situation in Nicobar group of islands is worse in comparison with Andaman group of islands. The tropical

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### Innovations & breakthroughs

Newly reported one malaria case with mixed species infection and one vivax malaria case with unusual clinical manifestation occurred in a South Asia island. It gives more information for understanding such kinds of malaria.

### Applications

It may help to understanding the clinical aspect of malaria and its importance for travel health.

### Peer review

Malaria is a life-threatening disease which contributes to significant morbidity and mortality, especially in developing countries. As a cases report, this manuscript is interesting for malaria research and travel health community.

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