

CASE REPORT

A Case of Rare Imported Plasmodium ovale Infection in Shaoxing

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SUMMARY

Background: Malaria is a global disease caused by the transmission of the malaria parasite through the bites of infected Anopheles mosquitoes. There are 4 kinds of common malaria parasites, among which oval malaria is mainly prevalent in tropical West Africa, with a narrow distribution range, mainly imported cases in China, which is relatively rare. Because the morphology, attack cycle, recrudescence and relapse are similar to those of Plasmodium vivax and, therefore, is easily missed and misdiagnosed.

Methods: Malaria parasite-specific antigens were detected in whole blood samples using rapid diagnostic tests (RDT). Peripheral blood was used to prepare thick and thin smears, which were then stained with Giemsa for the identification of malaria parasites and different parasite morphologies under an oil microscope. Plasmodium species were identified using fluorescence quantitative PCR.

Results: The patient's RDT revealed two red response lines (only T2 positive), indicating a single or mixed infection of three types of malaria (Plasmodium vivax, Plasmodium malarie, Plasmodium ovale) excluding Plasmodium falciparum. Thick smears exhibited various stages of Plasmodium such as hypertrophic rings and gametocytes, while thin films displayed Plasmodium trophozoites, gametocytes, etc., resembling oval malaria. The patients were diagnosed with Plasmodium ovum infection through fluorescence quantitative PCR, and targeted treatment was administered.

Conclusions: The incidence of Plasmodium ovum infection is low, and there is a risk of overlooking or misdiagnosing the infection in laboratory tests. It is essential for laboratory staff to enhance their morphological recognition skills for Plasmodium and to integrate blood routine analysis, RDT, and PCR results in order to facilitate early diagnosis and prompt treatment.

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KEYWORDS

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INTRODUCTION

Malaria, one of the six major tropical diseases worldwide, is prevalent in 102 countries and regions, posing a significant threat to global public health, particularly in tropical and subtropical areas [1]. In China, the successful elimination of malaria by WHO in 2021 can be attributed to the establishment of public health facilities effective multi-sectoral collaboration, and the implementation of the "1-3-7" strategy [2]. The development of the economy, increase in foreign exchanges, and labor exports have led to China still facing the risk of importing malaria from abroad. The common plasmodium par-

asites in China are falciparum malaria and vivax malaria, while *P. ovale* malaria is extremely rare [3]. Due to its similarity to the onset cycle of *Plasmodium vivax* and low density of recurrent patients, *P. ovale* malaria can easily be missed or misdiagnosed [4]. This study aims to describe the clinical manifestations, *Plasmodium* morphology, and treatment process of an imported case of *P. ovale* malaria in order to improve laboratory detection rates for plasmodium and provide assistance for early diagnosis and timely effective treatment.

CASE PRESENTATION

The patient, a 44-year-old male from Changsha, Hunan Province, had worked in Africa from 2019 to 2023. He arrived in Shaoxing for work on April 18, 2024 and sought treatment at the fever clinic of Shaoxing People's Hospital on May 5, 2024, due to "repeated fever for a week". The patient had a history of malaria infection with unknown specific plasmodium species and treatment drugs. His symptoms were relieved after treatment. Additionally, the patient has a history of hypertension and is currently taking oral antihypertensive medication. He denies any history of diabetes or exposure to poultry. During the week of repeated fever accompanied by body aches and chills, his body temperature was not measured but he took antipyretic drugs. Physical examination: Body temperature is 36.6°C; Pulse rate is 91 beats/minute; Blood oxygen saturation is 98%. Throat congestion, mild enlargement of tonsils, coarse breathing sounds in both lungs with no obvious rales or abnormalities. Laboratory tests show a white blood cell count of $5.41 \times 10^9/L$, with a neutrophil percentage of 68.9%, lymphocyte percentage of 17.6%, and monocyte percentage of 10.9%. The red blood cell count is $3.84 \times 10^{12}/L$, hemoglobin level is at 119.0 g/L, platelet count at $85 \times 10^9/L$, and whole blood high-sensitivity C-reactive protein at 63.92 mg/L. The RDT results indicated that the infection of three types of malaria, (*Plasmodium vivax*, *Plasmodium malarie*, *Plasmodium ovale*) excluding *Plasmodium falciparum*, was either a single infection or mixed infection. Thick and thin peripheral blood smears were prepared and stained with Riege's stain. The thick smears were magnified using an oil lens to observe the stages of plasmodium such as rings, trophozoites, and merozoites. The hypertrophic rings had one nucleus and vacuoles in the cytoplasm (Figure 1A, B). Thin section examination revealed slightly swollen infected red blood cells with some showing serrated edges, thick trophoblast ring, dark blue cytoplasm in about 1/3 of the red blood cells, and a larger nucleus (Figure 1C, D). Due to the possibility of malaria recurrence in clinic settings, blood was collected again and sent to Shaoxing CDC for further review. The case was comprehensively diagnosed as *P. ovalis* infection according to the WS216-2015 "Diagnostic Criteria for Malaria", based on epidemiological investigation, clinical symptoms, laboratory tests, and

other results. The patient was then treated with 2 tablets of piperquine dihydroartemisinin and 3 tablets of primaquine phosphate per day [5].

After the treatment, the patient's symptoms improved significantly.

DISCUSSION

Plasmodium ovale is one of the four major human plasmodium parasites, predominantly found in sub-Saharan Africa, the Middle East, Papua New Guinea, and South-east Asia. Its distribution range is relatively narrow and uncommon [6,7]. Imported cases of *P. ovale* malaria are also rare in China, exhibiting morphological similarities to *Plasmodium vivax* as well as similar attack cycles and recurrence mechanisms. Patients often present with atypical symptoms, making diagnosis challenging and increasing the likelihood of misdiagnosis or missed diagnosis [8,9].

The clinical symptoms of malaria infection in this patient resembled those of acute upper respiratory tract infection. Following a series of laboratory tests, it was confirmed that the patient had a rare imported form of malaria, which allowed for timely and effective treatment. Among these tests, microscopic examination holds significant value for the initial screening of malaria parasites. Microscopic thick and thin smear microscopy is a simple, cost-effective, and rapid routine method for diagnosing malaria. When combined with the detection of infected red blood cells by a hematology analyzer and the rapid detection test (RDT), the rate of detecting malaria parasites can be increased. However, microscopic examination is also influenced by factors such as timing of blood collection, quality of smears and staining, as well as the expertise level of inspectors conducting the microscopic examination. If the peripheral blood density is low, there is a higher likelihood of missed diagnosis; interference from platelets and debris during staining can also result in misdiagnosis. Additionally, due to the rarity of malaria cases in China, inspectors may have relatively weak recognition abilities when it comes to identifying the morphology of malaria parasites [10,11].

Based on this case, we propose the following recommendations for future malaria prevention and control: 1) Actively promote malaria awareness and education, particularly among individuals returning from high-risk malaria areas. If they experience fever or other suspected symptoms of malaria, they should proactively disclose their travel history to medical staff; 2) Enhance the detection rate of plasmodium by inspectors, strengthen their ability to prepare blood smears and identify plasmodium morphology under a microscope, and assist in plasmodium diagnosis through the identification of infected red blood cells in blood analyzers, rapid diagnostic tests (RDTs), PCR, and other methods to prevent missed detections; 3) Strengthen training for medical personnel in malaria prevention and control

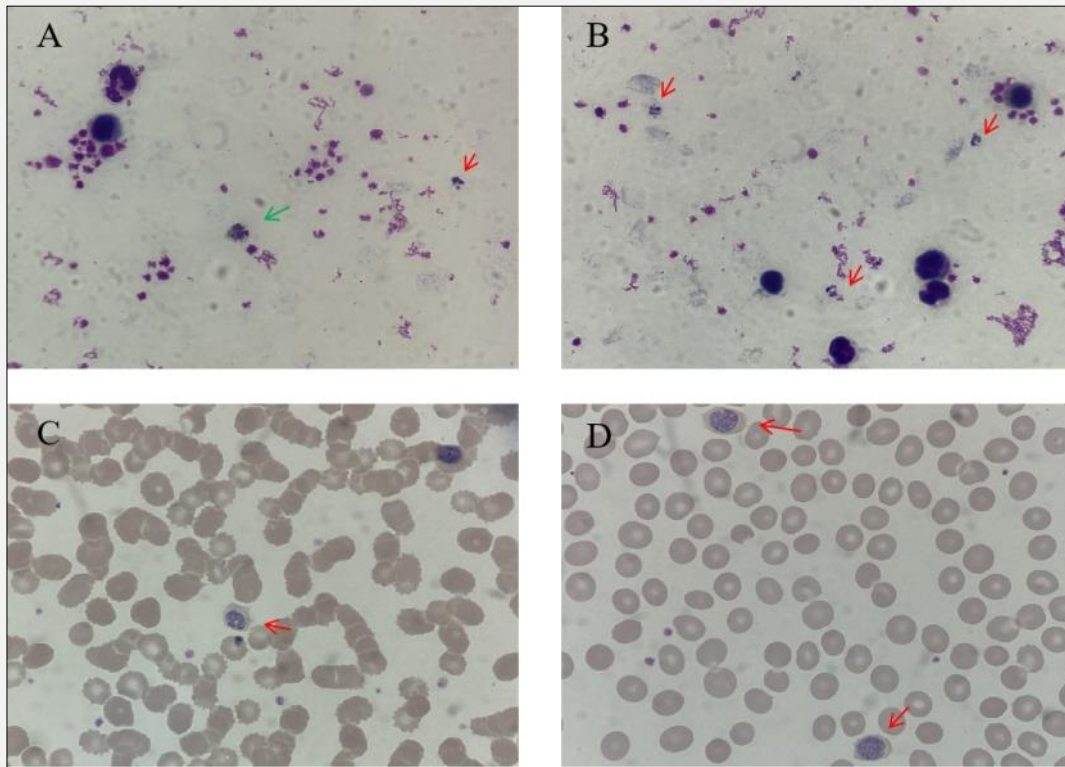


Figure 1. Morphological examination of Plasmodium ovale (Ridge stain, x 1,000).

A. Plasmodium ovalis annulus (red arrow), P. ovale malaria gametophyte (green arrow), B. Plasmodium ovalis annulus (red arrow), C. Malar-iozoon ovalis, D. Plasmodium ovale malaria gametophyte (red arrow).

skills, raise awareness of malaria prevention and control among key groups (such as migrant workers), engage in multidisciplinary collaboration, select appropriate anti-malarial drugs, and provide support for early diagnosis and timely treatment of patients.

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Declaration of Interest:

All authors declare that they have no competing interests.

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