

***Plasmodium ovale* species in Papua New Guinea - lest we forget**

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SUMMARY

The microscopical diagnosis of *Plasmodium ovale* infection is reviewed and its similarity to *Plasmodium vivax* emphasized. Its presence in Papua New Guinea has been recognized for many years, from a time not long after Stephens first described the species in 1922, but it is rarely reported. There is no doubt of its presence in Papua New Guinea, together with *P. falciparum*, *P. vivax* and *P. malariae*, but its exact prevalence and distribution has not been determined.

Introduction

The name *Plasmodium ovale* was proposed by Stephens in 1922 (1). It is one of the four species of protozoan parasites of the genus *Plasmodium* causing human malaria; the other three are *P. falciparum*, *P. vivax* and *P. malariae*. Recently, a new human malaria parasite has been identified, and it has been tentatively named the *Plasmodium vivax*-like malaria parasite (2). It remains to be clarified whether it is a fifth species of human malaria or a member of the *P. vivax* species complex (3).

The geographical distribution of the four human malaria parasite species is variable and is dependent on a number of factors such as season, endemicity and vector distribution. Generally, however, *Plasmodium vivax* is the most widely distributed and the most common species observed in temperate regions of the world, while *Plasmodium falciparum*, the most clinically dangerous of the malaria parasites, is most widespread throughout the world's tropics. *Plasmodium malariae* has the same geographical range as *P. falciparum*, but it is much less prevalent and occurs in more restricted zones. Records of *Plasmodium ovale* infection are scanty in all geographical areas of the malaria-endemic world, with the exception of tropical Africa. There it is routinely found, accounting for up to 10% of all malaria infections (4).

Though *Plasmodium ovale* infections are relatively uncommon outside tropical Africa, sporadic reports have come from a number of other regions of the tropics (5,6). However, in some parts of the tropical Western Pacific region *P. ovale* appears more consistently. *Plasmodium ovale* infections appear to be endemic in Irian Jaya and one report estimated a point prevalence of *P. ovale* of around 11% of all malaria species examined in an area (7,8). A prevalence of that magnitude was thought to occur only in tropical Africa but it seems that this may no longer be so. In Papua New Guinea *P. ovale* is considered a rare species but how rare is it?

Prevalence of *P. ovale* species in Papua New Guinea

The literature on *P. ovale* in Papua New Guinea is scanty giving the impression that *P. ovale* does not occur here. However, the first autochthonous case of *P. ovale* described from Papua New Guinea is said to have been in a male Duke of York Islander (East New Britain Province) in 1923 (9). After that, from 1942 to 1945, a total of seven cases of *P. ovale* were described, all of whom were apparently caucasians who had returned to Australia following a short- or long-term residency in Papua New Guinea. Before 1967, a total of ten cases of *P. ovale* malaria have been recorded,

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three cases from indigenous individuals and the remainder from caucasians (9,10).

Investigations have sought to determine the prevalence of the species in local surveys but the detection rate was either very low (11) or the species was unidentifiable (12). It is quite possible that this species could have been overlooked in many cases for the following reasons: 1) if adequately stained thin blood films were not examined; 2) if the microscopist was not sufficiently experienced; and 3) if the microscopist had not been specifically asked to look for this parasite. It does seem likely, however, that the reported cases of *P. ovale* in Papua New Guinea represent autochthonous ovale malaria. Therefore, special surveys should demonstrate the distribution of the parasite and permit further investigations of the epidemiology of this form of malaria.

Diagnostic dilemma of the *P. ovale* species

From the parasitological point of view, a number of factors are important in the diagnosis of this species. It is generally accepted that *P. ovale* cannot be adequately diagnosed in thick films especially if *P. vivax* is also endemic. The diagnosis of clinical malaria by the malaria service laboratories in Papua New Guinea is performed using thick blood film examination only. With this technique it is almost impossible to distinguish *P. vivax* and *P. ovale*, particularly for malaria microscopists who are not accustomed to finding the latter.

The fact that *P. ovale* has almost been ignored in the past decades is dependent on a number of factors. One is that the characteristic features of diagnostic importance that may aid in the definitive diagnosis of *P. ovale* are often not easily discernable. These diagnostic features include:

1. *The oval nature of the parasite with oval and fimbriated infected erythrocytes.* These are the hallmarks of the microscopic identification of *P. ovale* infection. The parasite was designated *ovale* because of the oval shape of the parasite but this cannot be completely relied on since the parasite can present with a rounded or circular shape. The

oval shape and fimbriated margins of the infected erythrocyte are also important diagnostic clues but are not a sine qua non of the species since only 20-30% of the infected erythrocytes will exhibit such features. Inheritable ovalocytosis is relatively common among Papua New Guineans and this may cause confusion when the oval shape of infected erythrocytes is used as a diagnostic feature.

2. *Appearance and prominence of the Schüffner's (James) dots.* The dots are stipplings on the infected erythrocytes associated with *P. ovale*. Attention has been drawn to that feature as a diagnostic criterion but the detection of the early appearance of the stipplings (dots) is dependent on the staining method. Furthermore, the dots, if present, resemble those normally associated with *P. vivax*, which often leads to misdiagnosis. Hence 'dots' or 'stipplings' is not a good criterion for the diagnosis of *P. ovale* species where *P. vivax* is prevalent.
3. *Ring forms.* Small 'rings' (young forms) of the parasite are indistinguishable from rings of other species. At this stage the erythrocytes are not enlarged and generally show no Schüffner's dots.
4. *Segmented forms.* In the segmented forms the maximum number of merozoites appears to be 12 or fewer in *P. ovale*. The early schizonts are like those of *P. vivax* when Schüffner's stippling is present and *P. malariae* when it is not. When mature schizonts show stippling and there are only 8-12 merozoites, *P. ovale* can be identified with confidence. However, those erythrocytes containing schizonts with 10 or more merozoites may be enlarged to the same extent as those containing schizonts of *P. vivax*, which can make the diagnosis of *P. ovale* under these conditions difficult.

Clinical significance of *P. ovale* species

A recent study showed that *P. ovale* can form rosettes (13), one of the characteristics

implicated for causing severe complicated malaria in *P. falciparum*. The clinical relevance of this finding remains unresolved. *Plasmodium ovale* is a minor human malaria parasite and does not cause severe and complicated malaria. However, *P. ovale* is one of the two species of human malaria parasite (*P. vivax* is the other) that has a dormant liver stage (with hypnozoites) following primary infection. The hypnozoites can develop into mature schizonts and release merozoites into the blood stream causing clinical symptoms of malaria (relapsing malaria) even many months after the primary infection. Since the therapy of *ovale* infection is not different from that of *vivax* malaria, the specific identification of *P. ovale*, it seems, is mainly of academic interest.

In conclusion, all four human malaria species occur in Papua New Guinea but the exact prevalence of *Plasmodium ovale* is unknown. I hope that this overview may serve to alert malaria microscopists to the possibility of finding *P. ovale* in routine blood film examination.

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