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CASE REPORT

Exflagellated Microgametes of *Plasmodium Vivax* in Human Peripheral Blood: An Uncommon Feature of Malaria

**C. S. B. R. Prasad · Narasimha Aparna ·
M. L. Harendra Kumar**

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Abstract In the life cycle of malarial parasite exflagellation of microgametes occur in mosquitoes. Usually this will not occur in the peripheral blood of human beings. However, exflagellation can occur in the collected blood and may create diagnostic dilemma. We report a case of *vivax* malaria with exflagellated microgametes, which were mistaken for a double infection of *vivax* malaria and borrelia.

Keywords Malaria · Exflagellation · Microgametes · Borrelia · Heparin

Case

40 year old male patient presented with a history of fever accompanied by chills and rigors of 10 days duration. At the time of presentation general examination was remarkable only for mild jaundice. Haemogram showed mild normocytic anemia with a hemoglobin of 10 gm/dl. Other red cell indices, total leukocyte count and platelet count were normal. Liver function tests revealed ALT 200 U/l, AST 350 U/l. Alkaline phosphatase and gamma GT were normal. Total serum bilirubin was 3.0 mg/dl with a direct component of 0.4 mg/dl. Peripheral blood smear examination revealed the presence of rings (Fig. 1 panel A), schizonts (Fig. 1 panel C) and gametocytes (Fig. 1 panel B) of *Plasmodium vivax*. In addition, there were a few structures resembling borrelia (Fig. 2). With these features an initial diagnosis of combined infection with malaria and borrelia was made. Out of interest we took some more fresh smears on the same day which, to our surprise failed to show structures resembling borrelia. This prompted us to look for borrelia antibodies, which turned out to be negative.

Pubmed search helped us to identify these structures resembling borrelia as exflagellated microgametes of malarial parasite [2, 5]. Patient responded well to antimalarials.

Discussion

Exflagellated microgametes of malarial parasites are know to occur in invertebrate host—mosquito [1]. However, it is not found with the usual developmental phase in humans [4]. Cases of exflagellation of malarial parasites have been reported in the literature [2–4, 7].

Exflagellation usually occurs in vitro solely by changes in pH in the blood as it moves from the environment of the circulation to that of the atmosphere, the pH rise being mediated by fall in carbon dioxide tension as the blood equilibrates with the atmosphere [1]. Solarte et al. [6] reported in their article that, some anticoagulants ex: EDTA may suppress exflagellation by depleting certain cations like Ca^{2+}, Mn^{2+} and Mg^{2+}, which are required for the activation of enzymes concerned with exflagellation[6]. They have concluded that for artificial membrane feeding (AMF) assay, heparin is the best anticoagulant [6].

In our case exflagellated microgametes were found in the smears made from heparinized blood which was lying in the laboratory for about an hour. Exflagellated

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C. S. B. R. Prasad · N. Aparna · M. L. Harendra Kumar
Department of Pathology, Sri Devaraj Urs Medical College, Sri Devaraj Urs University, Kolar, Karnataka, India

C. S. B. R. Prasad (✉)
"Prakrui", Vapasandra, North Exension, Chickballapur 562 101, Karnataka, India
e-mail: csbrprasad@gmail.com

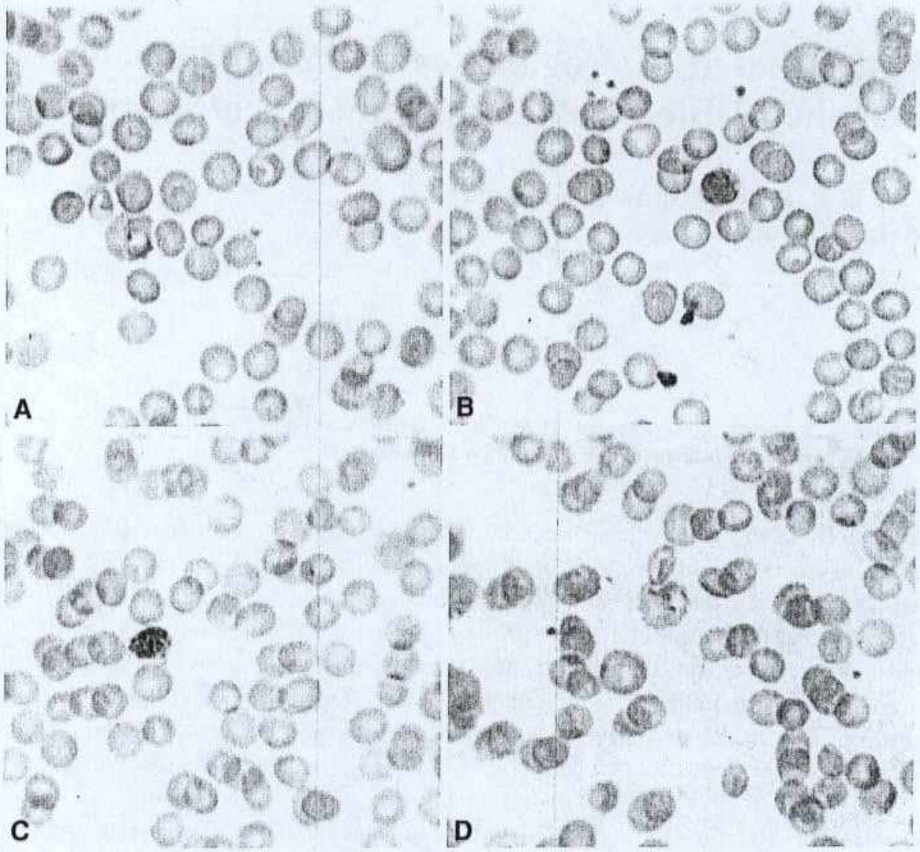

Fig. 1 Showing ring forms (panel *A*), schizonts (panel *C*) and microgametocyte (panel *B*)

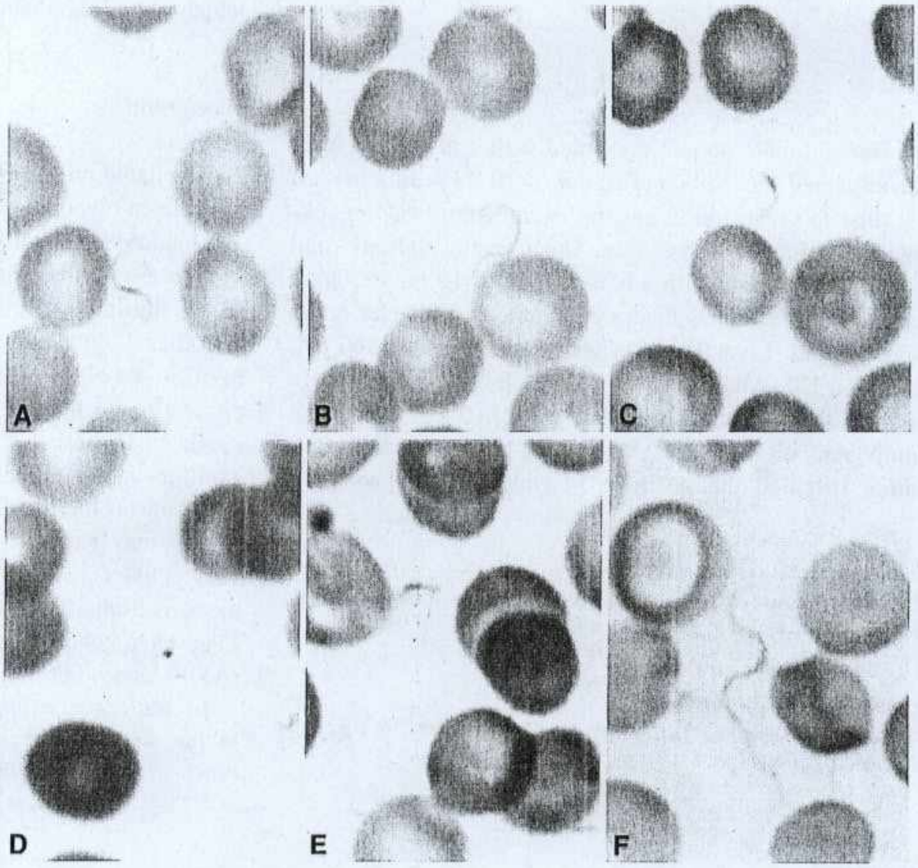

Fig. 2 Showing exflagellated microgametes. Chromatin is seen well in panels *A*, *C*, *D* and *E*. Sinuous nature is well seen in panels *A*, *B*, *E* and *F*

microgametes were not seen in the fresh smears made on the same day. From this we deduce that, exflagellation occurred in vitro facilitated by rise in pH of the blood as pointed out by Carter and Nijhout [1] and heparin by not altering the concentration of divalent cations as pointed out by Solarte et al. [6].

Exflagellated microgametes pose a diagnostic problem by their resemblance to borrelia, microfilaria or trypanosoma. However, morphology makes it easy to differentiate them from trypanosoma and microfilaria. Trypanosoma has undulating membrane, kinetoplast and a nucleus, where as exflagellated microgamete has only chromatin material. Microfilaria is larger, has multiple nuclei scattered through out its body and may have a sheath in addition. Hence, borrelia is the only strong contender in the differential. Exflagellated microgametes have sinuous body (All the panels in Fig. 2) with chromatin material (panels A, C, D and E in Fig. 2). Borrelia on the other hand has little kinks in their body and lack chromatin material.

Conclusion

This case illustrates that exflagellation may occur in vitro in blood collected from patients with *vivax* malaria. By morphological characters it is possible to differentiate these from microfilaria, trypanosomes and borrelia.

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