Short Report

Chloroquine-resistant *Plasmodium falciparum* malaria in Senegal

J. F. Trape[1], F. Legros[1], P. Ndiaye[1], L. Konate[1], I. B. Bah[2], S. Diallo[2], F. Verdier[3], I. Hatin[4] and J. Le Bras[4] *[1]Orstom, B.P. 1386, Dakar, Sénégal; [2]Département de Parasitologie, Université de Dakar, Sénégal; [3]INSERM U-13, Hôpital Claude Bernard, Paris, France; [4]Centre National de Référence pour la Chimiosensibilité du Paludisme, Hôpital Bichat-Claude Bernard, Paris, France*

Chloroquine-resistant *Plasmodium falciparum* has now been reported from an increasing number of countries in western Africa. Recently, 2 reports suggested the probable emergence of chloroquine resistance *in vivo* in the Senegambian region (MENON *et al.*, 1987; HELLGREN *et al.*, 1987). In Senegal, 3 isolates were found resistant *in vitro* in 1984/1985 (BRANDICOURT *et al.*, 1986; DRUILHE *et al.*, 1986); however, since nearly 500 isolates studied during the period 1985–1988 were fully sensitive *in vitro* (combined unpublished data from: Brandicourt; Diouf; Diallo; Le Bras) and no resistant case observed *in vivo*, Senegal was generally considered to be free from chloroquine resistance.

We report here 3 cases of chloroquine resistance observed in October and November 1988 during a study conducted in Pikine, a suburb of Dakar in Senegal, were most children and adults are non-immune.

The World Health Organization (WHO) 14-d extended test was successfully completed in 37 patients aged 1–55 years with acute *P. falciparum* malaria. 34 (92%) of the infections cleared after treatment (25 mg/kg over 3 d, tablets of Nivaquine®, Specia) and did not recur during follow-up. 3 (8%) of the infections were chloroquine-resistant (Table).

Patient C.S. became apyretic and asymptomatic on day 1. Illness recurred on day 12. *In vitro* sensitivity was investigated by two methods: the standard WHO microtest and the 3-hypoxanthine semi-microtest.

Table. Results of the 14-day test on 3 patients

Day	Parasitaemia and temperature[1] C.S. (8 years)		B.D. (3 years)		W.T. (11 years)	
0	22000	38°4	48000	39°6	40000	38°6
1	6400	37°1	160000	36°8	55000	37°8
2	880	36°7	3200	37°6	13000	36°7
3	20	36°3	68000	36°7	1400	36°6
4	0	37°4	1200	36°7	160	36°5
5	0	37°6	24000	36°9	240	36°6
6	0	37°6	1600	37°7	720	36°8
7	0	37°6	3000	36°7	2100	36°9
14	1200	39°1	5600[2]	39°5[2]	11500	37°5

[1]Parasitaemia per µl; axillary (W.T. and C.S.) or rectal temperature (B.D.), °C.
[2]Day 12 values.

Both tests indicated resistance, as schizonts matured in the presence of 6.4 µmol/litre of chloroquine (32 pmol per well, WHO microtest kits) and the 50% inhibitory concentration (IC_{50}) was 400 nmol/litre (semi-microtest). Whole blood chloroquine (Cq) and monodesethylchloroquine (CqM_1) concentrations on day 2 were 744 and 281 nmol/litre respectively (determined by high performance liquid chromotography).

Patient B.D. became apyretic on day 1 but headaches were reported until day 3. Illness recurred on day 11. As can be seen in the Table, parasitaemia fluctuated markedly during follow-up, suggesting resistance at the RIII level. Whole blood Cq and CqM_1 on day 2 were 966 and 140 nmol/litre respectively. Sensitivity *in vitro* was not studied.

Patient W.T. became apyretic on day 2 and asymptomatic (headache and weakness) on day 3. When the second treatment was given on day 20, parasite density was 29 000/µl and the temperature was 37·1°C. Careful examination and questioning failed to reveal any recurrence of fever or other symptoms. Tests *in vitro* indicated resistance: schizonts matured in the presence of 6·4 µmol/litre Cq (WHO microtest, day 0 and day 20 isolates); the IC_{50} was 380 nmol/litre (semi-microtest, day 20 isolate). Whole blood Cq and CqM_1 on day 2 were 1755 and 545 nmol/litre respectively (this patient had received 20 mg/kg by mistake on day 1).

Ten years after the first report in Kenya (FOGH *et al.*, 1979), this study demonstrates that chloroquine resistance *in vivo* has now reached the most westerly part of Africa. Furthermore, a high level of resistance was observed in 2 of the 3 first Senegalese cases, both of which were children who had never left the region of Dakar. Intensive surveys were carried out in Senegal during the period 1984-1988, and non-immune visitors to this country are numerous: it is interesting to note that 4 years separate the identification of a chloroquine-resistant strain from the emergence of resistance *in vivo*.

References

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