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Short Report

Increase of chloroquine resistance *in vivo* of *Plasmodium falciparum* over two years in Edea, south Cameroon

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Chloroquine-resistant falciparum malaria is progressively spreading, in Africa from east to west. In southern Cameroon chloroquine resistance was first reported by SANSONNETTI *et al.* (1985), but sensitivity was still at a high level (BRASSEUR *et al.*, 1986). We measured chloroquine sensitivity *in vivo* of *Plasmodium falciparum* in May 1989 in schoolchildren in the town of Edea (GAZIN *et al.*, 1990). To monitor the speed of emergence of resistance *in vivo* of *P. falciparum* we repeated the test in the same school classes and the same month in 1991.

Table 1. Characteristics of Edea schoolchildren in May 1989 and May 1991 before antimalarial treatment

	1989	1991
Number	190	191
Age (year)	9·0	8·9
Weight (kg)	25·9	26·6
Sex (male %)	45·0	51·4
Parasite rate (%)	64·5	67·4
Percentage of *P. malariae* or *P. ovale* in the infections	7·5	11·5
GMPD[a]	447	501
Spleen rate (%)	27·0	27·0
AES[b]	1·46 (SD=0·66)	1·70 (SD=0·74)

[a]Geometric mean parasite density (parasitized red blood cells/mm³ of blood) on day 0.
[b]Average enlarged spleen according to Hackett (see MANSON-BAHR & APTED, 1982); SD=standard deviation.

All pupils present on the first day of the study (day 0) were given 25 mg/kg chloroquine (Nivaquine®, Specia) orally over 3 d under supervision. Spleen rate, weight and parasite density were assessed. Parasite densities were assessed on days 3 to 7. Subjects with a parasitaemia on day 0 exclusively of *P. falciparum*, with parasite counts of at least 500 trophozoites/mm³, and who had taken their 3 d treatment on days 0, 1 and 2, were included in the sensitivity test. In 1991 chloroquine blood levels on days 0 and 3 were evaluated by means of an ELISA described by WITTE *et al.* (1990).

The groups did not differ significantly in number, age, weight, sex, spleen rate or parasite density on day 0 (Table 1). Sixty-eight children met the enrolment criteria in 1989 and 52 in 1991. Their parasitological results are given in Table 2.

In 1991, chloroquine levels on day 0 were between 0 and 140 ng/ml in 80% of the children included in the test. All children but one (98·6%) had blood levels between 140 and 560 ng/ml on day 3, with a mean level of 270 ng/ml (standard deviation=86·5).

In 1989, 12 of 68 children admitted to the study (17·5%) had demonstrated parasitological resistance *in vivo*. In 1991 resistance had increased to 44% (23 of 52 children). This difference was significant (χ^2=8·83, one degree of freedom, P<0·001).

Two subjects (2·9%) showed RIII resistance (no reduction in parasitaemia) in 1989; in 1991 this was so for 4 subjects (7·7%).

We conclude that chloroquine resistance is increasing rapidly in this region, emphasizing the need for constant monitoring in Central African countries and the development of alternative therapeutic schemes.

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Table 2. Prevalence and intensity of parasitaemia in Edea schoolchildren included in the chloroquine resistance test *in vivo*

	1989	1991	*P*
Number of children (day 0)	68	52	
Parasite rate (%)			
Day 3	24	38	0·08
Day 7	17·5	44	0·001
Geometric mean parasite density			
Day 0	1585	1993	NS[a]
Day 3	40	141	0·05
Day 7	141	108	NS[a]

[a]Not significant.

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