Airport malaria: a review

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Cases of malaria occasionally arise among individuals who have never visited a malarious area. Such patients, who also lack a history of blood transfusions or intravenous drug abuse, are usually shown to have "airport malaria". Most reports of airport malaria consist of case histories, although some epidemiological reviews have also appeared. The clinical and epidemiological features of 29 cases of airport malaria that were reported in Europe from 1969 to 1988 are reviewed here. Although airport malaria is rare, the apparent absence of risk factors for the disease in a patient's history can result in delays in diagnosis and appropriate treatment. Tests to exclude malaria should therefore be carried out on patients who work at or live near an international airport and who present with acute febrile illnesses.

Malaria has long been recognized as an important health hazard to travellers who have come from affected areas. Also, the increasing prevalence of drug-resistant strains of Plasmodium falciparum has greatly enhanced both the occurrence and the seriousness of malaria in nonimmune individuals. Provided medical practitioners are reasonably well aware of this risk, the possibility of malaria is unlikely to be missed in the great majority of affected travellers. It is therefore fundamental to the recognition of malaria and numerous other travellers' ills that geographical histories of patients be taken.

Much less well recognized, despite its periodic description in the medical literature, is airport malaria. By definition, such malaria is acquired through the bite of an infected tropical anopheline mosquito by persons whose geographical history firmly excludes exposure to this vector in its natural habitat. In such circumstances, diagnosis of malaria can be missed or delayed. Reports on airport malaria have usually concentrated on its epidemiology, while the clinical aspects frequently have not been analysed. In the present review an attempt has therefore been made to provide key clinical information about the condition.

Clinical and epidemiological data
A summary of data on 29 cases of airport malaria that occurred in Europe from 1969 to 1988 is shown in Table 1. Below are presented additional details on some of these cases.

- Patients 1 and 2, who had malaria in 1969, were described in 1970 by Cartier & Louvet (cited by Gentilini et al. (1)) as obscure cases of autochthonous malaria contracted while on holiday in Brittany, on the extreme western Atlantic seaboard of France. Following a reclassification of autochthonous malaria by Gentilini & Danis (4), these so-called “Breton cases” were reinvestigated by Doby & Guignen in 1981 (2). The two holiday-makers had become ill 11 days after their arrival from the Paris area, where they lived in a street adjacent to Le Bourget International Airport. It was concluded that they were probably infected by an imported mosquito just before they set off on holiday, and not by a local mosquito while on holiday, as had previously been believed.

- Patient 9 was one of the most intensively investigated cases (7). Numerous laboratory and other tests, including several blood counts, failed to reveal the true cause of his illness. He was treated for tuberculosis, until examination of liver biopsy tissue showed changes that were indicative of malaria.

- Patient 15 was a saxophonist who played in the French Republican Guard and was one of two cases of airport malaria reported during winter in Europe.
Table 1: Summary of the clinical and epidemiological data on the 29 published cases of airport malaria covered in the review

<table>
<thead>
<tr>
<th>Case number, age (years) and sex</th>
<th>Date of illness</th>
<th>Airport</th>
<th>Country</th>
<th>Distance: home to airport (km)</th>
<th>Occupation (at or near airport)</th>
<th>On admission to hospital</th>
<th>Before diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 31 F</td>
<td>August 1969</td>
<td>Le Bourget</td>
<td>France</td>
<td>0.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Adult M</td>
<td>August 1969</td>
<td>Le Bourget</td>
<td>France</td>
<td>0.5</td>
<td></td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3 Adult M</td>
<td>August 1970</td>
<td>Zurich</td>
<td>Switzerland</td>
<td></td>
<td>Soldier</td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>4 Adult M</td>
<td>August 1970</td>
<td>Zurich</td>
<td>Switzerland</td>
<td></td>
<td>Soldier</td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>5 60 F</td>
<td>August 1972</td>
<td>Zurich</td>
<td>Switzerland</td>
<td>“close”</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 27 M</td>
<td>October 1974</td>
<td>Orly</td>
<td>France</td>
<td>&lt;2</td>
<td>Ex-prisoner</td>
<td></td>
<td>15</td>
</tr>
<tr>
<td>7 57 M</td>
<td>July 1976</td>
<td>Charles de Gaulle and Le Bourget</td>
<td>France</td>
<td></td>
<td>Caretaker</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 20 M</td>
<td>August 1976</td>
<td>Charles de Gaulle</td>
<td>France</td>
<td></td>
<td>Cargo handler</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>9 41 M</td>
<td>August 1976</td>
<td>Charles de Gaulle</td>
<td>France</td>
<td></td>
<td>Airport storeman</td>
<td></td>
<td>&gt;42</td>
</tr>
<tr>
<td>10 76 M</td>
<td>August 1977</td>
<td>Charles de Gaulle</td>
<td>France</td>
<td>1.5</td>
<td>Pensioner</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>11 26 M</td>
<td>September 1977</td>
<td>Charles de Gaulle</td>
<td>France</td>
<td></td>
<td>Customs officer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 Adult M</td>
<td>August 1977</td>
<td>Charles de Gaulle</td>
<td>France</td>
<td></td>
<td>Policeman</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13 Adult M</td>
<td>June 1978</td>
<td>Charles de Gaulle and Le Bourget</td>
<td>France</td>
<td></td>
<td>Accountant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14 24 F</td>
<td>August 1978</td>
<td>Schiphol</td>
<td>Netherlands</td>
<td>0.3</td>
<td></td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td>15 45 M</td>
<td>February 1979</td>
<td>Charles de Gaulle</td>
<td>France</td>
<td></td>
<td>Guard’s band saxophonist</td>
<td></td>
<td>&gt;7</td>
</tr>
<tr>
<td>16 10 F</td>
<td>August 1979</td>
<td>Schiphol</td>
<td>Netherlands</td>
<td>&lt;2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17 18 M</td>
<td>July 1982</td>
<td>Brussels</td>
<td>Belgium</td>
<td>&lt;2</td>
<td>Mechanic</td>
<td></td>
<td>&gt;28</td>
</tr>
<tr>
<td>18 24 M</td>
<td>August 1982</td>
<td>Brussels</td>
<td>Belgium</td>
<td>&lt;2</td>
<td>Mechanic</td>
<td>6</td>
<td>20</td>
</tr>
<tr>
<td>19 27 M</td>
<td>1983</td>
<td>Brussels</td>
<td>Belgium</td>
<td></td>
<td>Baggage handler</td>
<td>Publican</td>
<td>14</td>
</tr>
<tr>
<td>20 48 M</td>
<td>July 1983</td>
<td>Gatwick</td>
<td>England</td>
<td>10</td>
<td></td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>21 Adult F</td>
<td>August 1983</td>
<td>Gatwick</td>
<td>England</td>
<td>14</td>
<td>Housewife</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>22 76 F</td>
<td>August 1984</td>
<td>Madrid</td>
<td>Spain</td>
<td>&lt;6</td>
<td></td>
<td>30</td>
<td>&gt;30</td>
</tr>
<tr>
<td>23 30 F</td>
<td>July 1985</td>
<td>Ciampino/ Fiumicino</td>
<td>Italy</td>
<td>5</td>
<td></td>
<td>3</td>
<td>31</td>
</tr>
<tr>
<td>24 Adult M</td>
<td>June 1986</td>
<td>Brussels</td>
<td>Belgium</td>
<td>25</td>
<td>Customs officer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25 Adult M</td>
<td>June 1986</td>
<td>Brussels</td>
<td>Belgium</td>
<td></td>
<td>Customs officer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>26 Adult M</td>
<td>June 1986</td>
<td>Brussels</td>
<td>Belgium</td>
<td></td>
<td>Customs officer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>27 Adult M</td>
<td>June 1986</td>
<td>Brussels</td>
<td>Belgium</td>
<td></td>
<td>Customs officer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>28 Adult M</td>
<td>June 1986</td>
<td>Brussels</td>
<td>Belgium</td>
<td></td>
<td>Customs officer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>29 67 F</td>
<td>December 1988</td>
<td></td>
<td>Italy</td>
<td></td>
<td></td>
<td>14</td>
<td>21</td>
</tr>
</tbody>
</table>

* A = anaemia; C = chills; D = diarrhoea; F = fever; H = headache; He = hepatomegaly; Hesp = hepatosplenomegaly; J = jaundice;
<table>
<thead>
<tr>
<th>Leukocyte count (× 10⁹/l)</th>
<th>Platelet count (× 10⁹/l)</th>
<th>Parasitaemia</th>
<th>Clinical features*</th>
<th>Outcome</th>
<th>Epidemiological comments</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Fe, N</td>
<td></td>
<td>C</td>
<td>Cases 1 and 2 were close friends and lived in the same street</td>
<td>(1,2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fe, coma. Malaria diagnosed at autopsy</td>
<td></td>
<td>D</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fe, H, Ma, Hesp</td>
<td></td>
<td>C</td>
<td>Cases 3 and 4 were stationed on a military base near the airport</td>
<td>(3)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fe, H, Ma, Hesp</td>
<td></td>
<td>C</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Infected with <em>P. malariae</em></td>
<td></td>
<td>C</td>
<td>Village virtually enclosed by the Orly runways</td>
<td>(1,4)</td>
</tr>
<tr>
<td>6.6</td>
<td>Numerous</td>
<td>Fe, C, H, MC</td>
<td></td>
<td>C</td>
<td>Lived ca. 6 km from airport</td>
<td>(1,4)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fe, J</td>
<td></td>
<td>C</td>
<td>Were cases 8 and 9, who had onset of illness 2 weeks apart, bitten by the same mosquito?</td>
<td>(5-7)</td>
</tr>
<tr>
<td>4.7</td>
<td>340</td>
<td>Fe, C, A, J, He, treated for tuberculosis; malaria than suspected on liver biopsy</td>
<td></td>
<td>C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.0</td>
<td>23%</td>
<td>Fe, C, D, V, cough, abdominal pain, dehydrated, schizonts</td>
<td></td>
<td>D</td>
<td>Were cases 10 and 11, who had onset of illness within 1 week, bitten by the same mosquito?</td>
<td>(5,6,8)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fe, J, RF, Hesp, circulatory collapse, coagulopathy infected with <em>P. vivax</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lived between Charles de Gaulle and Le Bourget</td>
<td>(4)</td>
</tr>
<tr>
<td>8.4</td>
<td>74</td>
<td>Fe, A, RF. Treated for Gram-negative sepsis</td>
<td></td>
<td>C</td>
<td></td>
<td>(10)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Scanty</td>
<td>recurrent D, followed 2 days later by Fe, C, and H</td>
<td></td>
<td></td>
<td>(11)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lived in Amsterdam but stayed near airport about 4 weeks before onset of illness</td>
<td>(10)</td>
</tr>
<tr>
<td>Normal</td>
<td>85</td>
<td>Numerous Fe, H, C, Sp. Gametocytes present</td>
<td></td>
<td>C</td>
<td></td>
<td>(12)</td>
</tr>
<tr>
<td>21.5</td>
<td>40</td>
<td>Numerous Fe, H, C, J, A, RF, coma, Hesp, gametocytes.</td>
<td></td>
<td>C</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fe, H, C, D, V, He. treated with erythromycin</td>
<td></td>
<td>C</td>
<td>Public house was popular with aircrews</td>
<td>(14)</td>
</tr>
<tr>
<td>4.4</td>
<td>Numerous</td>
<td>Influenza-like illness, D, J, abdominal pain. GP suspected and confirmed malaria.</td>
<td></td>
<td>C</td>
<td>Husband worked at airport. Wife passed public house 10 days before onset of her illness</td>
<td>(14)</td>
</tr>
<tr>
<td>2.6</td>
<td>Present</td>
<td></td>
<td></td>
<td>C</td>
<td>Visited daughter’s house near airport at the end of July</td>
<td>(15)</td>
</tr>
<tr>
<td>21.4</td>
<td>37</td>
<td>Numerous Fe, C, J, abdominal and chest pain. Gametocytes present</td>
<td></td>
<td>D</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>12 000/μl Fe, H, C, J, A, Sp. Pregnant</td>
<td></td>
<td>C</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>C</td>
<td>Cases 24-28 all worked in the same freight terminal and became ill within the same week—believed to have been bitten by the same mosquito.</td>
<td>(17)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Diagnosed as cerebral malaria with renal failure</td>
<td></td>
<td>C</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Diagnosed as cerebral malaria</td>
<td></td>
<td>D</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fe, H, A, J, coma. Gametocytes</td>
<td></td>
<td>C</td>
<td>Daughter-in-law returned from Senegal 20 days before onset of symptoms</td>
<td>(18)</td>
</tr>
</tbody>
</table>
(11). It was held probable that he had been bitten by a tropical anopheline mosquito while a member of a welcoming party for visiting VIPs who arrived in Paris on an aircraft from Côte d’Ivoire.

- Patients 17 and 18 were brothers, both mechanics, who lived near to, but did not work at Brussels International Airport (12). The elder brother (case 18) was hospitalized in a coma with fever, convulsions, jaundice, Cheyne-Stokes respiration, and renal failure. He underwent haemodialysis and supportive treatment, and within a week improved remarkably; during the following week, however, his anaemia recurred. After this patient had spent 3 weeks in hospital, malaria was diagnosed also in his younger brother (case 17); only then was a thick blood film from the elder brother examined and found to contain numerous *P. falciparum* gametocytes.

- Patients 20 and 21 lived in the vicinity of London Airport (Gatwick) (14). Patient 20 was landlord of a public house. When he became ill with fever and abdominal symptoms his doctor could find no localizing signs and treated him with erythromycin. Following an initial improvement, the patient’s symptoms recurred and eventually his condition deteriorated. After admission to hospital, a diagnosis of cerebral malaria was considered, despite a negative geographical history, and examination of blood films showed numerous *P. falciparum*. Erythromycin, which has marginal antimalarial efficacy, was thought to have been responsible for the initial transient phases of improvement. The public house was frequented by aircrews from Gatwick and it was assumed that an imported, infected mosquito must have brought the public house in a vehicle carrying aircrew from the airport. Patient 21 lived about 15 km south-west of Gatwick. Her husband drove daily to the airport where he worked, but he was not involved with aircraft in active service. Following thorough investigation it was thought that both patients 20 and 21 had probably been bitten by the same mosquito, although it remains unclear precisely how this occurred.

- Patient 22, a 76-year-old woman, had visited her daughter who lived near Madrid International Airport (15). Subsequently, the woman developed a febrile illness and respiratory symptoms and was treated for pneumonia; 30 days later she was hospitalized with a presumptive bacteraemia for which she was given penicillin and gentamicin; however, she did not respond and became jaundiced. Blood-film microscopy then revealed *P. falciparum* gametocytes and numerous trophozoites. The woman did not respond to treatment with chloroquine and was given quinine; however, she died a few days later of respiratory complications.

**Discussion**

**Definition of airport malaria**

The term “airport malaria” originally may have arisen from an erroneous translation of *paludisme aéroport* meaning literally “airborne” malaria, which was used by French workers in the late 1970s to identify a subclass of autochthonous malaria acquired through the bite of a tropical mosquito that had been imported by air (4). Autochthonous malaria was first defined as a case of the disease in metropolitan France that had been transmitted by local or imported mosquitoes, but excluded imported malaria in the form of human cases or carriers, transfusion malaria, accidental malaria, and congenitally acquired cases. Persons who become infected during brief stop-overs at airports in areas that are endemic for malaria or persons who are bitten in-flight by infected mosquitoes therefore do not meet the case definition.

**Clinical aspects**

Although most reports of airport malaria have supplied clinical information, emphasis has generally focused on the epidemiological aspects.

For all the cases reviewed, other routes of infection such as blood transfusion, shared needle transmission, prior exposure in endemic regions, and transmission by local mosquitoes had been excluded.

Table 1 shows some of the relevant clinical and epidemiological features of the cases reviewed.

The length of illness before patients were admitted to hospital ranged from 2 days to 30 days, with a median of 6 days (*n* = 11). The length of illness before malaria was diagnosed ranged from 4 days to more than 6 weeks, with a median of more than 14 days (*n* = 14). *P. falciparum* was responsible for 93% of the infections.

By the time parasites were first detected in samples of blood from the patients, gametocytes were present in four (31%) of 13 cases of falciparum malaria for which parasitological data were published. All four patients had been ill for 3 weeks or longer.

Quantitative parasitaemic data were reported for only 12 cases. A parasitaemia of 23% occurred in a 76-year-old man with a 3-day history of illness who also had occasional schizonts, and who died on the day after admission to hospital (case 10). Peripheral blood schizonts are rare in cases of falciparum malaria and indicate a poor prognosis. White blood cell counts ranged from 2.6 × 10⁹ per litre to 21.5 × 10⁹ per litre, with 70% being normal or below normal (*n* = 10).

For 21 patients it was established that at least

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740

two-thirds had severe or complicated malaria by the
time the cause of their illness was diagnosed. Among
the complications were cerebral malaria (6 patients),
jaundice (8 patients), anaemia (5 patients), and renal
failure (4 patients). One patient clearly had a
cogulopathy, as shown by a full coagulation profile,
but of six patients for whom platelet counts were
available only one was normal and five (83%) had
low platelet counts ranging from $34 \times 10^9$ per litre
to $85 \times 10^9$ per litre. The outcome of illness was
recorded for 24 patients for whom the case fatality
rate was 16.7%.

Parasites were rarely detected during the course
of routine haematological investigations, unless
microscopy for malaria parasites was specifically
carried out. The widespread use of automation in
haematology laboratories may be an important fac-
tor that contributed to the failure to detect the
parasites. Before automation was generally available,
malaria parasites were usually detected during
routine microscopy of thin blood smears for dif-
ferential white cell counts. Modern, automated
haematology equipment, which can perform both
total and differential blood counts, is, however, not
designed to recognize malaria parasites. Similarly,
thrombocytopenia may not be recognized. Leuk-
openia and thrombocytopenia are characteristic of
falciparum malaria (19) and should be used as
absolute criteria that indicate a need for urgent
investigation for malaria among patients who present
with an acute febrile illness.

**Epidemiological aspects**

The published data on airport malaria reviewed here
probably represent the more serious cases that
occurred in Europe from 1969 to 1988. Data on mild
cases may either not have been considered worth
publishing or the patients involved recovered sponta-
aneously without having been diagnosed as having
had malaria. Alternatively, serious or even fatal cases
of airport malaria may have been misdiagnosed. The
ture incidence of the condition and the true case
fatality rate cannot therefore be established
accurately. Of interest is its geographical distribution,
amall reported cases having occurred in Europe. This
may reflect the greater frequency with which
European airlines serve Africa. However, although
malarious regions of Asia and South America are
well served by non-European airlines, airport malaria
has not been reported from malaria-free areas in, for
example, North America or Japan. Possibly, airline
dissection procedures are more effective in some
countries than in others, but this aspect requires
further investigation.

**Entomological aspects**

The potential danger of disseminating the mosquito
vectors of malaria and yellow fever by means of
aircraft was first recognized more than 50 years ago.
In 1986, searches of 27 aircraft from six airlines that
had arrived at Nairobi Airport yielded some 150
adult mosquitoes, including some *Anopheles gambiae*.
Highton & van Someren (20) have suggested that
mosquitoes enter aircraft while they stand at night
in open hangars under artificial lights for routine
maintenance. Other workers have proposed that,
especially during nocturnal stop-overs, the light
and warmth of the open passenger cabin and the carbon
dioxide emitted by jet engines attract female mos-
quitos in search of a blood meal (4, 21). This is
important in view of the frequent requirement,
especially in Africa, that passengers remain aboard
during brief refuelling stops.

Modern dissection procedures have not yet
eliminated the risk of transporting vectors of exotic
diseases, as indicated by the 967 arthropods collected
from 592 aircraft that landed at Piarco International
Airport, Trinidad, West Indies (22). Live mosquitoes
were also detected in 12 of 67 aircraft that arrived at
London Airport (Gatwick). Some of these mos-
quitos were resistant to organophosphate insecticides
and, in addition to disseminating disease, the genes
that code for insecticide resistance could be dissemi-
nated worldwide in this way (23).

In trials carried out by Russell (24) on insects
that were carried in small cages attached to the
internal walls of the inner wheel bays of Boeing 747B
aircraft, more than 80% of culicine mosquitoes sur-
vived in each of six flights that lasted from about 1.5
hours to more than 9 hours. Whereas the external
temperature varied between $-47^\circ$C and $-54^\circ$C
at cruising altitude, in the wheel bays the temperature
was as high as 28°C and never fell below 8°C. Wheel
bays are non-pressurized, but the extremely low
atmospheric pressures at the aircraft cruising
altitudes did not affect most of the insects studied.
Russell suggested that, in addition to the cabins and
the cargo hold, dissection of the wheel bays should
therefore be considered.

Once a mosquito arrives at an airport, how far
can it travel? In some cases of airport malaria, the
mosquito, after disembarking, may have been further
transported in a motor vehicle (14). However, in view
of the short distances involved in most cases of
airport malaria, the responsible vectors may often
have continued their travel unassisted. Even in tem-
perate climates this is feasible during periods of
the year when climatic conditions are favourable.

With few exceptions, most cases of airport malaria
occurred from late June to September, i.e., during the
warmer part of the year in Europe. Active dispersal of *A. gambiae* can be as much as 7 km under favourable wind conditions. When temperature and humidity are favourable, as is often the case during the height of the European summer, imported tropical mosquitoes can not only remain alive but also move around considerably. Fertilized female anophelines will then attempt to obtain periodic blood meals, which are essential for the maturation of successive batches of ova. If disturbed while feeding, such mosquitoes may bite several hosts to obtain the required amount of blood.

**Vector control in aircraft and at international airports**

Various methods have been used for the dissection of aircraft, but the “blocks away” method is still most favoured. This involves manual aerosol application of a specified insecticide to the passenger cabin “and all other accessible interior spaces of the aircraft, except the flight deck” after embarkation of passengers and closure of the doors, but before take-off; the flight deck is treated separately (23). Empty aerosol cans must be produced on arrival as evidence of dissection.

Airlines are responsible for vector control on their aircraft, but the airport health authority must keep the area within the airport perimeter free of the vectors of diseases of epidemiological significance to international health, and must prevent disease vectors from gaining access to aircraft (26).

The number of air travellers now exceeds 1000 million annually (21) and in that context airport malaria is an unusual event. It has been suggested by Delmarre & van der Kaay that apart from asking “Where have you been and when?” the question “Where do you live?” should also be posed when patients are interviewed (10).

**Résumé**

**Le paludisme aéroporté: une mise au point**

Depuis plus de 20 ans, on signale régulièrement en Europe occidentale des cas de paludisme aéroporté. Le présent article passe en revue 29 cas qui sont examinés des points de vue épidémiologique et clinique. La plupart sont survenus en plein été, c’est-à-dire dans des conditions climatiques favorables à la survie des moustiques tropicaux. La majorité des patients vivaient à proximité d’un aéroport assurant des liaisons avec des régions d’endémie palustre ou travaillaient dans un tel aéroport ou dans ses environs immédiats, et plusieurs d’entre eux étaient appelés à manipuler le fret ou les bagages, soit comme porteurs, soit comme douaniers. Tous étaient atteints de paludisme à *Plasmodium falciparum*, sauf deux chez lesquels on a identifié *P. malariae* et *P. vivax*, respectivement. Sur les douze patients pour lesquels on dispose de données quantitatives concernant la parasitémie, un seul a été déclaré faiblement infesté; pour les autres, les parasites sanguins ont été qualifiés de “nombreux”, ou bien la parasitémie, exprimée par le pourcentage d’érythrocytes infestés, se situait entre 5% et 20%. Des gamétocyties étaient présents chez quatre patients sur treize au moment où les plasmodies ont été détectées pour la première fois dans le sang. En outre, un frottis de sang périphérique a montré la présence de schizontes chez l’un des quatre patients qui sont décédés, un homme de 76 ans dont 23% des érythrocytes étaient parasités. Onze patients étaient malades depuis deux à trente jours (valeurs médianes; six jours) lorsqu’ils ont été admis à l’hôpital, et dans quatorze cas, il s’est écoulé de quatre jours à plus de six semaines (médiane: 14 jours) entre le début de la maladie et son diagnostic. Dans un cas, le diagnostic a été porté à l’autopsie, et dans un autre à la suite d’une biopsie du foie. Soixante-dix pour cent des numérations leucocytaires étaient normales ou inférieures à la normale, et la numération plaquettaire pratiquée chez six patients a révélé une thrombopénie dans tous les cas sauf en complication de 21 patients, les deux tiers souffraient de complications au moment où le paludisme a été diagnostiqué; il s’agissait de paludisme cérébral (six patients), d’insuffisance rénale (quatre patients), d’ictère (huit patients), d’anémie (cinq patients) et de coagulopathie (un patient). Le taux global de léthalité a été de 16,7%.

Il convient de noter que la plupart des appareils automatiques utilisés pour la numération sanguine ne sont pas conçus pour reconnaître les plasmodies; la recherche du paludisme doit donc être explicitement demandée pour tout patient atteint d’une maladie fébrile, surtout si le nombre des leucocytes et des plaquettes est inférieur à la normale. Le fait qu’un malade réside ou travaille à proximité d’un aéroport international doit faire
penser au paludisme. Pendant les escales, surtout en Afrique, il est maintenant fréquent que les passagers soient obligés de rester à bord de l’avion, portes ouvertes et lumières allumées. Dans ces conditions, les moustiques sont attirés à l’intérieur de l’avion et les passagers risquent davantage d’être piqués par des insectes infectés que s’ils se trouvaient dans une salle de transit climatisée.

References
