Locally-acquired *Plasmodium falciparum* malaria on Darnley Island in the Torres Strait

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Australia was declared malaria-free by the World Health Organization in 1981. Locally acquired malaria is now uncommon in north Queensland. During the 1990s, 4 cases of locally-acquired *Plasmodium vivax* malaria were reported from north Queensland, consisting of single cases in Cape York[1] and Cairns[2] and 2 on Badu Island in the Torres Strait.[3] The Torres Strait however, has a real risk of malaria transmission due to its proximity to Papua New Guinea (PNG) where malaria is endemic. We report on a locally-acquired case of *P. falciparum* malaria on Darnley Island in the Torres Strait.

The index case

The Tropical Public Health Unit in Cairns was contacted on 23 March 2001 regarding a 29-year-old man from the Torres Strait (Darnley Island, Figure) who was smear positive for *P. falciparum* malaria. The man had presented to the clinic on 19 March 2001 with headache and muscle pain, which had been present since 17 March 2001. No diagnosis was made but he re-presented for review on 22 March 2001. On that occasion he had a temperature of 40.4°C, joint pain, cough, headache and loose bowel motions. Blood films for malaria collected that day were positive with 51,937 *Plasmodium falciparum* per uL. Ring forms were present but no gametocytes (the sexual forms of the parasite) were seen. He was commenced on quinine sulphate the same day and subsequently made a good recovery.

The index case had not left the island during 2001 apart from fishing trips within a short distance offshore. More particularly, he had not visited PNG. Interviews with the patient and several acquaintances confirmed this. Therefore, he was presumed to have acquired *P. falciparum* infection on the island. Prior to symptom onset his routine in the evenings was to sit either on the beach or inside his partially-screened house. The only exceptions were on the evening of 8 March when he was at a church funeral and feast until about 22:00, and on 2 March when he was at the community canteen from about 17:30 until 02:00 the next morning.

Potential sources of *Plasmodium falciparum* malaria on Darnley Island

In 2001 there were 2 cases of *P. falciparum* malaria on Darnley Island, with onset dates prior to the index case (Table). Several PNG nationals had visited Darnley Island and could have introduced *P. falciparum*. A group of 5 PNG nationals from Kadawa village (Figure) had been on Darnley Island for 2 to 3 weeks up until 24 March 2001. A sixth member of this group, a male in his early 30s from Parama (Figure), left the island on about 11 March after developing headache and joint pain. He did not seek medical care.

A second group (father, mother, and 2 sons) from Daru Island stayed on Darnley Island from 2 to 15 March 2001. The father became unwell and was reviewed at the clinic on 13 and 14 March when he was treated empirically with quinine (Fansidar® was recommended but not taken). Malaria screening was not performed.

Two additional family groups encompassing 13 people from Kadawa village, attended a church gathering on Darnley Island in mid-December 2000 and stayed until 1 March 2001.

Entomological investigations

In addition to mosquito trapping, emergency mosquito control measures were implemented on Darnley Island to minimise the risk of further transmission of *P. falciparum*. The primary vector of malaria in Australia, *Anopheles farauti sensu lato (s.l.)*, is widespread in the Torres Strait but is generally found in low numbers on Darnley Island.[4] Darnley Island is hilly, with few swamps. *Anopheles* breeding near the community is limited to 4 small tidal creeks, a mangrove swamp and small puddles. No *Anopheles* larvae were collected during larval surveys of the area. Adult mosquitoes were collected with CDC light traps baited with 1 kg of dry ice and octenol and set on 27 March near the index case's house and wooded areas within 1 km of the house. All traps were placed upwind of insecticidal fogging operations. Only 4 female *Anopheles* mosquitoes, consisting of 3 *An. farauti s.l.* and an *An. annulipes* were collected in the traps.

The Darnley community was fogged for mosquitoes after a public meeting to advise residents. A Dyna-Fog model 2605 Superhawk™ thermal fogger was used to apply bioresmethrin (Resilin™) at 200 mL/ha on the evenings of 26 and 27 March 2001. Most of the community was fogged from the main road using a 4WD vehicle.

Public health responses

A member of the Tropical Public Health Unit reviewed any patients who presented to the island clinic with fever between 24 and 26 March 2001. Malaria screening of a 49-year-old man and a 5-month-old girl with fevers was negative. The malaria case was discussed with island councillors, and posters warning of the risk of malaria and recommending the use of preventative measures were displayed around the villages. There have been no

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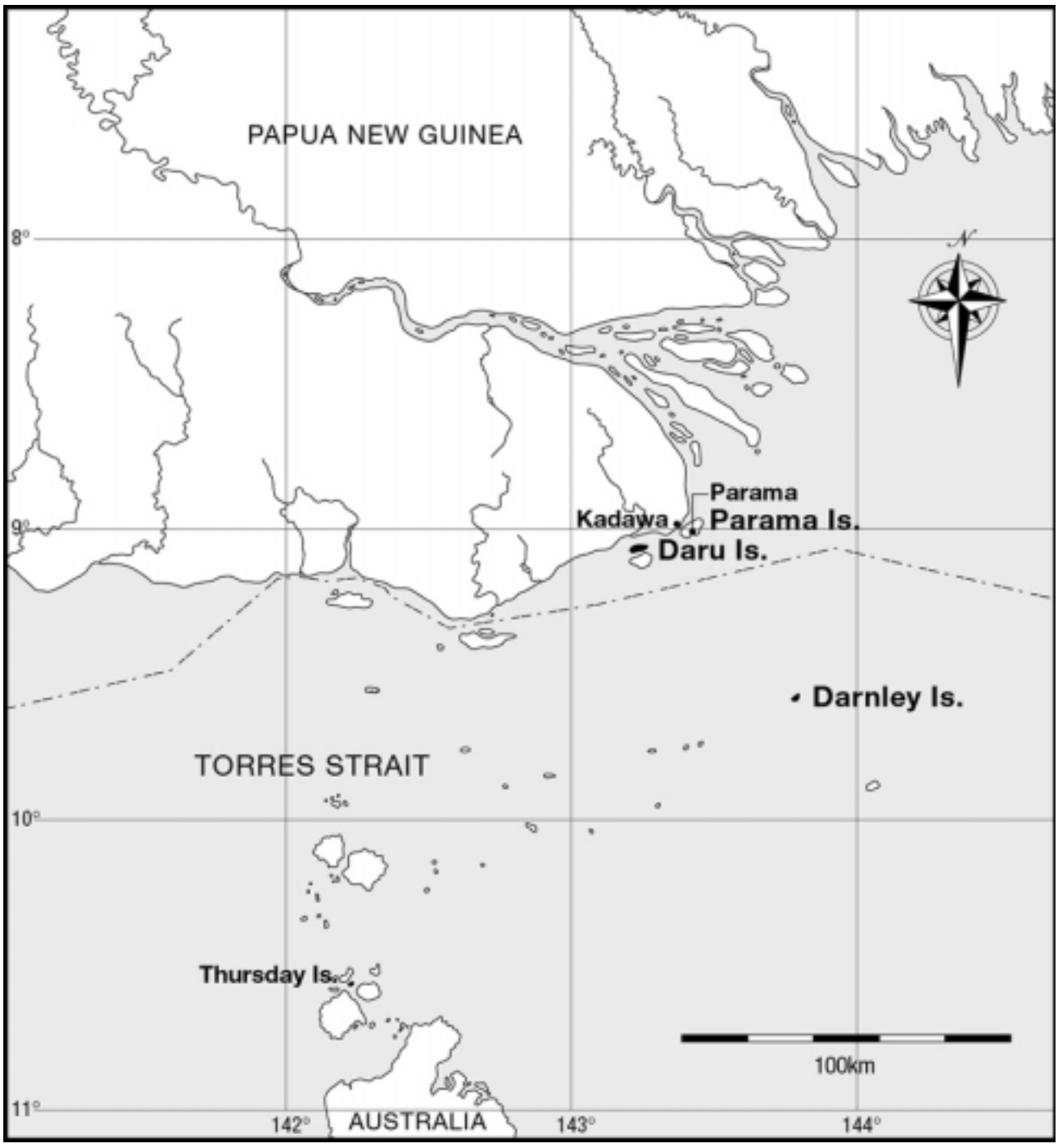
Table. Cases of *Plasmodium falciparum* malaria with onset before the index case in 2001

Characteristic	Case 1	Case 2
Sex and age	M, 11 yr 4 mo	M, 2yr 1 mo
Onset or presentation date	3 Jan 2001	9 Feb 2001
Date of first smear	4 Jan 2001	11 Feb 2001
Parasite count	40,287/uL	5,150/uL
Gametocytes	No	No
Comments	PNG national who had been on the island a few weeks.	Local, but spent April 2000 to January 2001 on Daru Island, PNG. Transferred to Thursday Island Hospital 9 Feb 2001

Figure. Map of the Torres Strait and Papua New Guinea



subsequent cases of *Plasmodium falciparum* malaria on the island at the time of writing.

Discussion

The shortest incubation period for *P. falciparum* malaria is 7 days, and 95 per cent of cases develop symptoms within one month.[5] The index case was, therefore probably infected between 10 February and 10 March 2001. The duration of sporogony (the exogenous sexual phase in the *Anopheles* vector) is 9-10 days for *P. falciparum* at 28°C.[6] Therefore, the mosquito that infected the index case would have taken an infective blood-meal between about 1 February and 1 March, or perhaps even a little earlier.

It is possible that individuals from the first 2 PNG groups mentioned above could have introduced *P. falciparum* malaria onto Darnley Island as 2 individuals sought medical attention on 11 and 13 March 2001. Depending on the onset of their symptoms and their respective incubation periods, they may have been infectious to *Anopheles* mosquitoes at the appropriate time. No members of the other 2 family groups became unwell while on the island. Depending on the human host's previous exposure and level of immunity, however, *P. falciparum* parasitaemia can produce minimal or no symptoms.[5] Thus, one of these people could have been the source of infection. Neither of the known *P. falciparum* malaria cases occurring on the island prior to the index case was likely to have been the original source of his infection because neither case was gametocytaemic. Both were treated promptly, and one was immediately evacuated from the island. It is possible that an unrecognised case of *P. falciparum* malaria occurred in one of the PNG nationals on the island. Another source of local transmission could have been an infected mosquito that arrived on a boat from PNG. Malaria-infected *Anopheles* transported on aeroplanes ('airport malaria')[2] and boats[3] have transmitted malaria.

Entomological investigations suggest that the risk of malaria transmission on Darnley Island is small. No larvae were found in the limited breeding sites sampled. Few female *An. farauti s.l.* were collected, although numbers could have been reduced by insecticidal fogging. Nonetheless, the presence of a locally-acquired malaria case indicates that malaria transmission is possible in the Torres Strait despite a small population of vectors, although the likelihood of a large outbreak is very small.

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References

1. Brookes DL, Ritchie SA, van den Hurk AF, Fielding JR, Loewenthal MR. *Plasmodium vivax* malaria acquired in far north Queensland. *Med J Aust* 1997;166:82-3.
2. Jenkin GA, Ritchie SA, Hanna JN, Brown GV. Airport malaria in Cairns. *Med J Aust* 1997;166: 307-8.
3. Merritt A, Ewald D, van den Hurk AF, Stephen S, Jr., Langrell J. Malaria acquired in the Torres Strait. *Commun Dis Intell* 1998;22:1-2.
4. van den Hurk A, Ritchie SA. Japanese encephalitis in the Torres Strait: Surveillance of suspected vectors. *Arbovirus Research in Australia* 1996;7:105-111.
5. Warrell DA. Clinical features of malaria. Gilles HM, Warrell DA, eds. Bruce-Chwatt's Essential malariology. London, Boston, Melbourne, Auckland: Edward Arnold, 1993;35-49.
6. Gilles HM. The malaria parasites. Gilles HM, Warrell DA, eds. Bruce-Chwatt's Essential Malariology. London, Boston, Melbourne, Auckland: Edward Arnold, 1993;12-34.