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A serological survey of rickettsial infections in the Gazelle Peninsula, East New Britain and a review of the literature

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SUMMARY

Of the various rickettsial diseases, only scrub typhus has been well documented in Papua New Guinea. A review of the historical literature confirms this. A serological survey was conducted on 113 antenatal patients presenting to a district hospital in Kokopo, East New Britain. Results suggested that a spotted fever rickettsial infection is common in this area with a seroprevalence of about 17% in young women. There was no evidence of scrub typhus or murine (endemic) typhus in the population sampled. Clinical implications of these findings are discussed.

Introduction

The typhus group of infections is caused by small intracellular bacteria from the genera *Rickettsia* and *Orientia*. They are transmitted to humans by arthropod vectors, the reservoir being small mammals and/or the arthropods themselves. They cause a variety of illnesses in humans, usually presenting as a high fever with no obvious cause (pyrexia of unknown origin [PUO]) associated with headache and myalgia. Some of the diseases are characterized by an eschar, at the site of the bite and inoculation by the arthropod vector. A rash is also a common clinical feature of rickettsial disease. The diseases respond well to doxycycline or chloramphenicol treatment. Diagnosis is usually confirmed serologically. The diseases can be divided into three broad groups – the typhus group (TG), the spotted fever group (SFG) and scrub typhus.

The typhus group includes endemic (or murine) typhus (*Rickettsia typhi*), which is transmitted by fleas. Gunther was the first person to describe any rickettsial diseases in Papua New Guinea (PNG) (1,2). However, his description of cases of 'endemic typhus in New Guinea' in 1935 were most likely cases of scrub typhus. Epidemic typhus (*R. prowazekii*) is a more severe disease, also of this group, transmitted to humans by the human body louse. Epidemic typhus has been documented in PNG (3), as has murine typhus in Indonesian Papua, the western half of the island mass (4).

The spotted fever group comprises a large number of rickettsial species in many parts of the world, including *R. australis*, which causes Queensland tick typhus. These diseases are usually transmitted to humans by ticks. To our knowledge no study has documented serologic evidence of spotted fever group rickettsiae in PNG, though it has been recently described in West Papua, Indonesia (5).

Scrub typhus, caused by *Orientia tsutsugamushi* (formerly *Rickettsia tsutsugamushi*), is transmitted to humans by mites and is well documented in PNG. The first probable cases of scrub typhus were documented from Bulolo in 1935 (1). In 1937 fourteen cases of 'Japanese river fever' were described from the Wau goldfields and included two deaths (6). In 1944 the Medical

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Journal of Australia reported a series of 626 cases of scrub typhus in Australian troops during World War Two admitted to hospital in Port Moresby, with a case fatality rate of 9.7% (7). These cases came from various locations all over mainland PNG but mostly from the Kokoda Track areas. In 1945 literature reviews of scrub typhus in South-East Asia (8,9) included 105 cases from Morobe, Madang, the Sepik and New Britain, with a case fatality rate of 13-19%. Also in 1945, an epidemic of scrub typhus was reported in troops stationed on Bat Island (Manus Province), with 26 cases, representing two-thirds of the exposed personnel, becoming infected over a 6-week period, with two deaths (10). *O. tsutsugamushi* was isolated from rat spleens from islands off the north coast of West Papua (11).

The aim of our study was to investigate the presence of rickettsial infections in the Kokopo area of East New Britain Province.

Materials and Methods

Blood was collected, with patient's consent, as an addition to the routine antenatal blood tests done on 113 pregnant patients randomly presenting to St Mary's Hospital Vunapope during 2002 and 2003. Serum was frozen and sent to the Australian Rickettsial Reference Laboratory in Geelong, Victoria for processing. A rickettsial microimmunofluorescence screening test was done at a serum dilution of 1/128 and if positive further tests were performed by testing sera for antibodies against rickettsia of the typhus group (*R. typhi*, *R. prowazekii*), spotted fever group (*R. australis*, *R. honei*, *R. conorii*, *R. siberica*, *R. rickettsii*, *R. akari*) and scrub typhus group (Gilliam and Kato strains of *O. tsutsugamushi*). Sera were also tested for ehrlichiae (*Ehrlichia chaffeensis* and *Anaplasma phagocytophilum*). An antibody titre greater than or equal to 256 was taken as indicating previous infection.

Results

The results of serological testing are summarized in Table 1. Of the 20 cases that tested positive to rickettsiae, 19 were positive to SFG/TG at a titre of 256 or greater. The typhus group antibodies were very likely cross-reacting antibodies as none of the typhus titres was greater than the corresponding SFG titres. There were no positives for the scrub typhus group. There was one positive for *Ehrlichia chaffeensis* (human monocytic ehrlichiosis).

Discussion

These results suggest that a spotted fever group rickettsial infection is quite common in this part of East New Britain with a prevalence of about 17% (19/113) in young women. It is very likely this infection presents as an undifferentiated fever and is initially treated as malaria. If a patient continued to have fevers after antimalarial treatment then they would often be given chloramphenicol, which would effectively treat this disease. It is very unlikely that a rickettsial disease would be suspected in these patients. It is probable that this disease is transmitted to humans by a tick bite. This may be associated with an eschar (Figure 1) and should be looked for in any patient with an undiagnosed fever, as an eschar would strongly suggest a rickettsial disease. If the transmitting ectoparasite is a tick, then they probably live in a life cycle with a bush rodent or native animal such as a possum.

These results show no evidence of previous scrub typhus in the population sampled. This was somewhat surprising as scrub typhus is known to occur in many parts of PNG. Indeed Blake et al. described 3 cases from the Kokopo-Bita Paka area in 1945 (8). The fact that scrub typhus transmission is very localized regionally and also that we do not know what part of the Gazelle Peninsula our cases came from make it difficult to comment on the true prevalence of scrub typhus in this part of PNG. Our results also produced no evidence of murine (or endemic) typhus nor epidemic typhus in the sample population.

The results of this study and the reviewed literature have some implications for clinicians working in PNG. They should think of rickettsial diseases as a possible cause of PUO (especially if a patient has an eschar or a rash). If a rickettsial disease is suspected, treatment with doxycycline or chloramphenicol is appropriate. If facilities are available then the diagnosis should be confirmed serologically.

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TABLE 1

POSITIVE RICKETTSIAL SEROLOGY FROM 20 OF 113 ANTENATAL PATIENTS FROM KOKOPO, EAST NEW BRITAIN, PAPUA NEW GUINEA

		Spotted fever group rickettsiosis						Typhus group		Scrub typhus[1]		Ehrlichiosis	
Case No	Screening[4]	*R. australis*	*R. honei*	*R. conorii*	*R. siberica*	*R. rickettsii*	*R. akari*	*R. typhi*	*R. prowazekii*	Gilliam	Kato	*A. phago*[2]	*E. chaff*[3]
1	Positive	128	256	NT	128	-	128	-	-	-	-	NT	-
2	Positive	256	256	NT	128	-	-	-	-	-	-	NT	-
3	Positive	512	512	256	256	256	512	-	-	-	-	-	-
4	Positive	256	512	256	256	512	256	-	-	-	-	-	-
5	Positive	256	256	128	128	128	128	-	-	-	-	-	-
6	Positive	256	256	256	256	256	256	-	-	-	-	-	-
7	Positive	128	256	128	128	128	128	128	256	-	-	-	-
8	Positive	256	128	128	256	256	-	-	-	-		-	-
9	Positive	256	256	256	256	256	128	128	256	-	-	-	-
10	Positive	128	256	128	256	256	128	128	128	-	-	-	-
11	Positive	256	256	-	128	256	256	-	-	-	-	-	-
12	Positive	128	256	128	128	256	128	128	256	-	-	-	-
13	Positive	256	128	256	256	256	256	256	256	-	-	-	-
14	Positive	1024	1024	256	256	512	1024	256	256	-	-	-	-
15	Positive	512	1024	512	256	256	512	-	-	-		-	-
16	Positive	256	256	128	-	256	-	-	-	-	-	-	-
17	Positive	-	-	128	-	128	-	-	-	-	-	-	256
18	Positive	128	128	128	128	128	256	-	-	-	-	-	-
19	Positive	256	256	256	256	256	256	-	-	-	-	-	-
20	Positive	256	256	256	-	256	256	-	-	-	-	-	-

- = negative (<128); NT = not tested
[1]*Orientia tsutsugamushi*; [2]*Anaplasma phagocytophilum* (human granulocytic ehrlichiosis); [3]*Ehrlichia chaffeensis* (human monocytic ehrlichiosis);
[4]Screening done at a serum dilution of 1/128, by microimmunofluorescence

Figure 1. Typical eschar associated with rickettsial disease.

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