Emergence of chikungunya fever on the French side of Saint Martin island, October to December 2013

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On 18 November 2013, five residents of Saint Martin presented with severe joint pain after an acute episode of dengue-like fever. Epidemiological, laboratory and entomological investigations provided evidence of the first autochthonous transmission of chikungunya virus in the Americas. The event indicates a risk of epidemics in America and Europe through substantial passenger traffic to and from continental France. We describe detection and confirmation of the first six cases and results of the first weeks of surveillance.

On 16 and 18 November 2013, through health event intelligence, separate signals from two sources, a patient and a hospital practitioner, reached Public Health Nurse (PHN) and epidemiologists, respectively. Five residents of a Saint Martin district called Oyster Pond, which straddles the two sides of the island, presented with severe joint pain after an acute episode of dengue-like fever. Following the alerts, two investigations were carried out in Oyster Pond.

Detection and confirmation of the first six cases: health event activity

Epidemiological surveillance and health event activities on Saint Martin before the outbreak

Saint Martin and Sint-Maarten are parts of the same Caribbean island and are, respectively, French and Dutch overseas territories. Epidemiological surveillance and health event intelligence activities on the French side are performed through a network of health professionals including epidemiologists from the French Institute for Public Health Surveillance (Cire), public health nurses (PHN) from the Regional Agency for Health (ARS), hospital and general practitioners, local laboratory and professionals of vector control. This network has been in place for many years to monitor, for example, the epidemiology of dengue fever that is endemo-epidemic in the French West Indies [1].

Investigations following the first signal of the health event

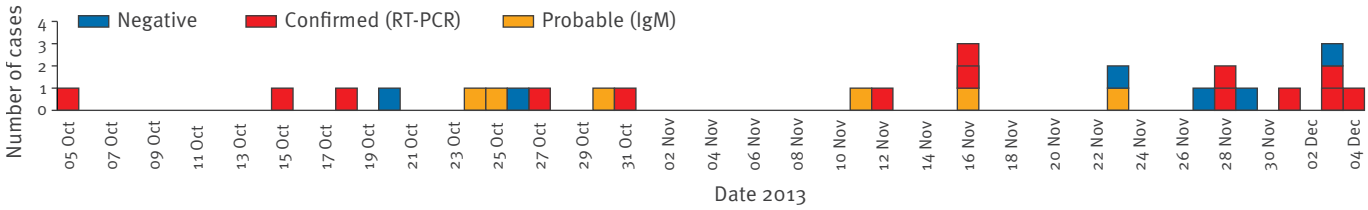
On 21 and 22 November 2013, standardised interviews and an entomological survey were conducted in the Oyster Pond district. In addition to the first five notified patients, three further patients were detected during the investigations in the district and, finally, eight patients were interviewed: five women and three men whose age ranged from 49 to 73 years. Their dates of symptom onset ranged from 15 October to 12 November; fever was acute, with a high temperature ranging from 38.8 to 39.5 °C. Five patients reported rashes (erythema, maculae, papules and, in one case, vesicles). All eight had incapacitating pain, most often in the joints of hands or feet, preventing day-to-day activities. Seven patients also had oedema in the painful joints. Available laboratory data suggested a viral infection because of a normal white cell blood count and a normal level of C-reactive protein, but the specific laboratory tests to confirm dengue fever were negative (IgM and NS1 test) [2-3]. None of the patients reported travelling to countries other than continental France, the Virgin Islands, the United States and Germany, all countries unaffected by chikungunya virus (CHIKV).

A dengue epidemic was ongoing on Saint-Martin at the time, and the vector (*Aedes aegypti*) was present on the island. The entomological investigation following the signal showed a higher density of these mosquitoes in the Oyster Pond district compared with other areas. This observation made a mosquito-borne disease plausible, but the negative laboratory tests suggested a cause other than dengue virus (DENV).

Blood samples of the eight patients were tested in the French National Reference Centre for Arboviruses in Marseille, mainland France. On 2 December 2013, serology results for two cases were positive for CHIKV (IgM). A first positive RT-PCR [4] result for another case was received on 5 December. Overall, six of the eight suspected cases could by laboratory-confirmed: four had positive IgM tests, one had a positive RT-PCR, one

Figure

Epidemic curve of chikungunya fever cases by date of symptom onset, Saint Martin, 5 October–4 December 2013 (n=26)



had positive results in both tests. The remaining two patients were negative in both tests. The six confirmed cases were classified as autochthonous, since they had no travel history to countries affected by CHIKV. Diagnostic tests for DENV were negative for all six.

The full-length viral RNA genome was characterised by the French National Reference Centre for Arboviruses, in Marseille. Importantly, the virus did not belong to the East Central South African genotype but to the Asian genotype, phylogenetically related to a number of strains recently identified in Asia (Indonesia 2007, China 2012 and the Philippines 2013) [5].

Detection of later cases

Improvement of surveillance

After the confirmation of virus circulation on Saint Martin, the following four objectives were established for future chikungunya surveillance: detect all new suspected cases in a timely manner, collect epidemiological data, confirm cases by laboratory tests and monitor the spread of the disease on the French side of Saint Martin. Collaboration with the Dutch side of the island was also enhanced with meetings and data exchange, although the preparedness plan did not specifically include such actions.

The definition for a suspected case of chikungunya fever was sent to all hospitals and general practitioners as follows: (i) a patient with onset of acute fever >38.5 °C and with at least one of the following symptoms (headache, retro-orbital pain, myalgia, arthralgia, lower back pain) and who had visited an epidemic or endemic area, or (ii) a patient with acute fever >38.5 °C and severe arthralgia of hands or feet not explained by another medical condition.

For laboratory confirmation, it was recommended that doctors request simultaneous tests for dengue and CHIKV for all patients fulfilling the case definition. The laboratory in charge of taking blood samples had to fill in a form including the date of symptom onset, date of sample, the address and phone number of the patient. These data were transmitted to epidemiologists and vector control staff. Spatial distribution of the cases was analysed using the addresses provided for all patients.

As for the first detected cases, all blood samples collected during this second phase of surveillance had to be sent to the National Reference Laboratory in Marseille, France. The laboratory results allowed classification of the clinical suspected cases as follows: invalidated case if all the tests were negative, probable case if only serology (IgM) was positive, confirmed case if RT-PCR was positive, confirmed co-infection if RT-PCR was positive for dengue and CHIKV in the same sample.

Overall results for all 26 suspected cases with laboratory test by 4 December 2013

The epidemic curve (Figure) summarises, by date of symptom onset, the first 26 patients tested between 5 of October and 4 December 2013. These include the first eight patients described above as well as a further 18 suspected cases with available laboratory test. Of those 26, 20 were identified as probable or confirmed cases. Seven probable or confirmed patients were male and 13 were female; the median age was 50 years (range 6–72 years). No patient had to be hospitalised. In addition to these 26 patients, 10 were seen by a doctor who considered that their symptoms fulfilled the criteria of a suspected case, but these patients, probably because of a mild condition, did not go to the laboratory for blood sample taking.

The period of approximately two weeks between the first confirmed case and the subsequent two confirmed cases is consistent with the time required for the contamination of a mosquito, the extrinsic cycle of the virus in this mosquito, the stinging of another patient by this infected mosquito and the incubation period in the new patient. This temporal pattern was repeated for the later groups of probable and confirmed cases occurring in November 2013.

Discussion and conclusion

Epidemiological, laboratory and entomological investigations of the first cases provided evidence for the first active transmission of CHIKV in the Americas.

At the time of the investigations, information available about the international epidemiological situation of chikungunya fever was scarce. During 2013, cases had been reported in Bali, Indonesia, Java, the Pacific Ocean (Micronesia, New Caledonia), the Philippines and Singapore [6]. Several states in India (Gujarat, Kerala, Nad, Odisha and Tamil) also reported an increased number of cases [7]. This is of relevance because of the substantial passenger traffic between the Indian community of Saint Martin and India, and indicates a risk of importing cases from India.

The timeliness of the alert, despite the simultaneous dengue fever epidemic, was made possible by three factors. The first was the health event intelligence system organised in the French West Indies, which aims to confirm and assess the risk of every unusual health signal transmitted (via telephone or email) by a health professional or a patient [8].

The second was the awareness of the risk of introduction and transmission of CHIKV on all Caribbean islands, since the major epidemic on Reunion Island in 2006 [9]. Between 2006 and 2009, nine travellers entering the French West Indies were diagnosed with confirmed CHIKV infection, one of them on Saint Martin [10]. Seven of them had arrived from Reunion Island and two from India. Vector control activities were implemented around each of these imported cases, and none led to local transmission. Although Girod and Coll confirmed vector competence of *Ae. aegypti* (the only vector mosquito genus present in the French West Indies) for CHIKV transmission [11], no indigenous transmission of this virus had been observed in the Americas since [12].

The third factor of timeliness was the chikungunya preparedness plan which is similar to that for DENV, integrating activities of surveillance, laboratory, communication, patient care and vector control. Following the alert of 2006 and the risk of virus spread from potential other imported cases, the Cire and ARS teams of all the French territories in the Americas had decided to implement a preparedness and response plan for CHIKV introduction. Suspected and confirmed case definitions were standardised, laboratory resources for confirmation identified in the region, and first response activities implemented. This plan ('Programme de Surveillance, d'Alerte et de Gestion' (Psage)), based on the Integrated Management Strategy recommended by the World Health Organization for DENV, included four phases of increasing epidemic risk. At the time of the outbreak in 2013, Saint Martin was in the first risk phase, which required reporting of suspected and confirmed cases of CHIKV by clinicians and diagnostic laboratories to the local Health Event-dedicated cell of the corresponding Regional Agency for Health (Martinique, Guadeloupe or French Guiana). Epidemiological and entomological investigations were to be conducted simultaneously in the neighbourhood of the reported cases.

This regional alert has a wider impact: if the epidemic continues to spread in the Caribbean region and the Americas during the coming months, imported cases in southern Europe may have the potential to cause local outbreaks during the summer season.

Conflict of interest

None declared.

Authors' contributions

Sylvie Cassadou and Martine Ledrans: management and coordination of the investigations. Severine Boucau: implementation of investigations. Marion Petit-Sinturel: data management. Patricia Huc: blood sample taking and management. Isabelle Leparc-Goffart: Chikungunya tests (RT-PCR and Serology).

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