Transactions of the Royal Society of Tropical Medicine and Hygiene (2008) **102**, 780—786

available at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevierhealth.com/journals/trst

Outbreak of Chikungunya fever in Mayotte, Comoros archipelago, 2005—2006

Daouda Sissoko[a,*], Denis Malvy[b], Claude Giry[c], Gilles Delmas[d], Christophe Paquet[d], Philippe Gabrie[c], François Pettinelli[c], Marie Anne Sanquer[e], Vincent Pierre[a]

[a] *Cellule Interrégionale d'Epidémiologie Réunion Mayotte, Direction Régionale des Affaires Sanitaires et Sociales, 2 bis Avenue Georges Brassens, BP 50, 97408 Saint-Denis Cedex 9, La Réunion, France*
[b] *Département des Maladies Infectieuses et Tropicales, Centre Hospitalier Universitaire de Bordeaux and Centre René Labusquière, Université de Bordeaux II, Bordeaux, France*
[c] *Centre Hospitalier de Mayotte, Rue de l'Hôpital 976000 Mamoudzou, Mayotte, France*
[d] *Institut de Veille Sanitaire, Saint-Maurice, France*
[e] *Direction des Affaires Sanitaires et Sociales de Mayotte, BP 104, 97600 Mamoudzou, Mayotte, France*

Received 22 November 2007; received in revised form 22 February 2008; accepted 22 February 2008
Available online 8 April 2008

KEYWORDS
Chikungunya virus;
Polyarthralgia;
Disease outbreak;
Arboviruses;
Community survey;
Comoros

Summary In 2005—2006, a large outbreak of Chikungunya (CHIK) fever occurred on the western Indian Ocean Islands. In Mayotte, concurrent with an enhanced passive case notification system, we carried out two surveys. A seroprevalence survey designed to document recent CHIK infection was conducted on serum samples collected from pregnant women in October 2005 ($n = 316$) and in March—April 2006 ($n = 629$). A cross-sectional clinical community survey carried out from 2 to 10 May 2006 among 2235 individuals was designed to determine the cumulative incidence of presumptive CHIK fever cases. The seroprevalence of recent infection among pregnant women was 1.6% in October 2005 and rose to 26% in April 2006. The clinical community survey showed that nearly 26% of respondents had experienced presumptive CHIK fever between January and May 2006. Extrapolated to the overall population of Mayotte, these figures lead to an estimated attack rate of 249.5 cases per 1000 population as of early May 2006. Nine patients with the maternofetal form and six subjects with the severe form were recorded. This first emergence of CHIK fever in Mayotte lead to a very large outbreak. Efforts to strengthen surveillance and prevention of arbovirus infection are needed at country and regional levels.

1. Introduction

Chikungunya (CHIK) virus is a single stranded positive RNA-enveloped virus of the family *Togaviridae*, genus *Alphavirus*,

* Corresponding author. Tel.: +33 262 939 422; fax: +33 262 939 457.
E-mail address: daouda.sissoko@sante.gouv.fr (D. Sissoko).

0035-9203/$ — see front matter © 2008 Royal Society of Tropical Medicine and Hygiene. Published by Elsevier Ltd. All rights reserved.
doi:10.1016/j.trstmh.2008.02.018

within the Semliki Forest virus antigenic complex. It is primarily transmitted to humans through the bite of infected *Aedes* mosquitoes (Jupp and McIntosh, 1988). The acute phase of CHIK fever arises after an average time of 5 days of silent incubation. It is characterized by sudden high fever accompanied by headache, intense muscle pain and, frequently, a mucocutaneous eruption. Moreover, the characteristic and disabling joint pain leading to bent positions gave the name to the disease, which means 'that which bends up' in an East African language (Robinson, 1955). This rheumatic manifestation leads to a secondary phase characterized by inflammatory involvement accompanied by severe incapacitating polyarthralgia combined with oedema and stiffness. It mainly affects the joints of the metacarpus and phalanges, wrist, elbow, shoulder, knee, ankle and metatarsus. In approximately 10% of patients, the CHIK fever related polyarthralgia shows a chronic and disabling pattern (Brighton, 1981; Brighton et al., 1983).

CHIK virus distribution covers a wide area including Africa, the Indian subcontinent, Southeast Asia and certain Pacific islands (Jupp and McIntosh, 1988; Lam et al., 2001; Muyembe-Tamfum et al., 2003; Thonnon et al., 1999). In these regions, the incidence of CHIK fever is associated with vector density and climatic conditions (environmental temperature, rainy season) (Jupp and McIntosh, 1988). Nevertheless, some epidemiological features depend on the continent. In Africa, CHIK virus infection dynamics tend to be endemo-epidemic and the disease affects primarily rural populations. In this situation, the level of population immunity to CHIK virus is important, and outbreaks are limited and often unrecognized (Kuniholm et al., 2006; Muyembe-Tamfum et al., 2003; Thonnon et al., 1999;). By contrast, in Asia, CHIK virus infection dynamics generally can be categorized as epidemic and the agent seems to affect mainly peri-urban and urban areas; in this setting outbreaks seem more explosive (Mackenzie et al., 2001; Padbidri and Gnaneswar, 1979).

In the middle of 2004, an outbreak of CHIK fever flared up in Lamu (Kenya), then reached Moroni, Comoros Islands, at the beginning of 2005, before spreading to the islands of the whole Southwest Indian Ocean, including Mayotte, Reunion Island, Mauritius, the Seychelles and Madagascar. These events constituted an exceptionally widespread outbreak. The attack rates of the outbreak in Lamu and in Grande Comore (Comoros) were respectively estimated at 75% and 63% according to serological surveys (Chretien et al., 2007; Sergon et al., 2007). In Reunion Island, an estimate as of 16 April 2006 argued for a number up to 244 000, i.e. 35% of the island's population (Renault et al., 2007).

This paper describes the first CHIK fever outbreak in Mayotte, using data from a case notification system and the results of seroprevalence and community-based surveys conducted during April and May 2006.

2. Methods

2.1. Study area and setting

A detailed description of the general and public health conditions in Mayotte has been published elsewhere (Sissoko et al., 2003). Briefly, Mayotte Island is part of the Comoros archipelago (Mozambique Channel, southwestern Indian Ocean), which is under French administration. The climate is tropical maritime, with a hot rainy season from November to April and a temperate dry season from May to October. The population, according to the 2002 census, was 160 300, i.e. 468 inhabitants per km^2. Most live along the eastern coast, mainly in urban areas. The population is young (56% are under 20); 70% are native-born and 30% are of foreign origin (Insee Mayotte, 2003). Medical care is provided by 19 primary care centres and the territorial hospital centre of Mayotte (CHM) comprising two chief sites, in the capital city of Mamoudzou and in Dzaoudzi, in addition to private general practitioners who are nearly all located in Mamoudzou. Recourse to traditional medicine is also frequent. Furthermore, some of the population, mostly of Comorian origin, are no longer covered by social health insurance, which provides free treatment, since social security insurance grounding in the French national model was introduced in April 2005.

2.2. Surveillance methods

On 16 March 2005, the Global Alert and Response Network (GOARN) reported an outbreak of CHIK fever in the neighbouring Island of la Grande Comore. The French authorities and health care providers, particularly in Reunion Island and Mayotte, were immediately informed and awareness of CHIK fever arose. In mid-April 2005, physicians in Mayotte noticed an increase of acute febrile illness associated with polyarthralgia. Blood specimens obtained from indigenous residents of Mayotte tested positive to CHIK virus. Subsequently, the first occurence of CHIK virus in Mayotte was recognized. An enhanced passive case notification system managed by the highest local health authority, the 'Direction des affaires sanitaires et sociales (Dass Mayotte)', was implemented over the entire island. Health care providers and hospitals were encouraged to report clinically suspected and laboratory confirmed CHIK fever cases. In addition to the above case notification system, an active hospital-based surveillance was instituted on 24 January 2006, to identify serious and maternofetal forms.

2.3. Laboratory methods

Serum samples were tested at the CHM laboratory for IgM antibody to CHIK virus with an IgM immunocapture assays (MAC-ELISA) (Pastorino et al., 2004). Specimens were also tested for IgG to CHIK virus with an IgG ELISA (Johnson et al., 2000). Antigens for tests were prepared by the French National Reference Centre for Arboviruses and WHO Collaborating Centre for Haemorrhagic Fevers and Arboviruses, Pasteur Institute, Lyon, France (CNR des Arbovirus). The cut-off point for positive samples was established as optical density (OD) $\geq$ the threshold (calculated as the average negative control OD + 3 SD) according to the manufacturer.

RT-PCR detection of CHIK virus genome was performed using the Superscript One-Step RT-PCR with Platinium Taq kit (Invitogen, Carlsbad, CA, USA) (Pastorino et al., 2005).