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General review

Epidemiology of chikungunya infection on Reunion Island, Mayotte, and neighboring countries

Épidémiologie du chikungunya à la Réunion, Mayotte et dans les pays avoisinants

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Abstract

Since 2004, the frequency of chikungunya virus infections has been increasing in Africa, Indian Ocean islands, and Asia. The epidemic began on the Kenyan coast, and reached the Comoros at the end of 2004 before spreading to the South-western Indian Ocean islands (SWIOI) in 2005 and especially in 2006. The epidemic then spread to Asia where epidemic foci are still active today. This increase also affected temperate zone countries where imported cases were reported, and indigenous transmission was reported in Italy in 2007, and in France (Var) in 2010. This review provides an update on the knowledge gained from monitoring chikungunya infections in SWIOI. Despite significant differences in design and performance, the implementation of surveillance systems has allowed describing the evolution of epidemic waves in the affected areas. Synchronous epidemic waves were observed in SWIOI, despite the differences between the preventive measures locally implemented. Between 2005 and 2007, all SWIOI were in inter-epidemic situation, except for Madagascar where a persistent virus circulation in an endemic-epidemic pattern was observed. In 2009, and in 2010, two moderate indigenous outbreaks were identified on the Reunion Island by the inter-epidemic surveillance system. Strains analyses demonstrated a reintroduction of the virus from Madagascar. These limited outbreaks should be a reminder of the vulnerability of SWIOI to arbovirosis, since the entomological indexes for competent vectors are high and the virus keeps on circulating more or less actively in the area.

Keywords: Chikungunya; Reunion Island; Mayotte; Indian Ocean

Résumé

Depuis 2004, on observe une recrudescence des infections dues au virus chikungunya en Afrique, dans les îles de l'océan Indien et en Asie. L'épidémie a débuté sur la côte kenyane, a atteint les Comores fin 2004 avant de toucher l'ensemble des îles du sud-ouest de l'océan Indien (ISOOI) en 2005 et surtout en 2006. L'épidémie a ensuite gagné l'Asie où des foyers épidémiques sévissent encore aujourd'hui. Cette recrudescence implique les pays tempérés puisque des cas importés y ont été signalés et une transmission autochtone a été rapportée en Italie en 2007 et dans le Var en 2010. Cette revue fait le point sur les connaissances acquises à partir de la surveillance des infections à chikungunya dans les ISOOI. Malgré d'importantes différences de conception et de performances, les dispositifs de surveillance mis en place ont permis de décrire l'évolution des vagues épidémiques. Un déroulement synchrone des vagues épidémiques dans les ISOOI a été constaté en dépit des différentes mesures de lutte mises en place. Entre 2005 et 2007, toutes les ISOOI étaient en situation interépidémique, sauf Madagascar où une circulation virale persistante sur un mode endémo épidémique était observée. En 2009, puis en 2010, deux foyers de transmission autochtone d'ampleur modérée ont été identifiés à la Réunion par le dispositif de surveillance interépidémique. Les analyses de souches ont montré une réintroduction du virus depuis Madagascar. Ces foyers confirment la vulnérabilité des ISOOI face au virus chikungunya dans la mesure où les indices entomologiques y sont élevés pour des vecteurs compétents et où le virus continue d'y circuler plus ou moins activement.

Mots clés : Chikungunya ; La Réunion ; Mayotte ; Océan Indien

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1. Introduction

The chikungunya virus is an arbovirus transmissible to humans by a vector mosquito of the *Aedes* genus. The virus reservoir is man and the infected vector.

Chikungunya virus infection usually presents as: fever, headaches, and incapacitating joint and muscular pain. Even though less frequent, other symptoms may appear such as rashes, or mild hemorrhagic signs [1]. Usually, the disease has a rapid and favorable outcome and patients acquire a long-term immunity [2] but chronic presentations with persistent arthralgia are frequent [3]. A small rate of severe presentations and deaths, as well as cases of mother to neonate viral transmissions were reported for the first time during the Reunion island 2005–2006 epidemic [4–6].

Since the first epidemic reported in 1953 in what is now Tanzania [7], numerous local epidemics were reported in Africa [8–11] and Asia [12–15], where virus reemergence was sometimes observed after years or even decades of absence [16,17]. Since 2004, the virus circulation has been increasing and massive chikungunya epidemics have been reported in Africa, Indian Ocean, and in Asia [4,18–21]. Phylogenetic studies revealed the homology of all recently isolated viral strains which come from lines of Central and East African origin, thus confirming the part of international exchanges in the diffusion of the pathogenic agent [22,23]. Imported cases in travelers coming from epidemic zones have been reported in several temperate zone countries [24,25] and an epidemic identified in Italy was associated to a virus imported from India by an infected traveler [26].

These epidemics were described in each of the concerned country as if it were every time a local phenomenon occurring behind human frontiers. Thus, up to now, no synthesis study has ever been made recalling the epidemic dynamics for the entire affected geographic zone. The main objective of this review was to perform this synthesis for countries of the southwest Indian Ocean zone (Fig. 1) and to describe more precisely the epidemiological situation in the Reunion Island and Mayotte. The secondary objectives were to identify the particularities and similitudes of the epidemic process to determine, if needed, the domains for which complementary studies would be necessary to better grasp the chikungunya dynamics in this zone and especially in the Reunion Island and Mayotte.

2. Material and methods

A review of publications having mentioned the epidemic was made so as to identify a posteriori the concerned countries of the southwest Indian Ocean zone. Surveillance data of the chikungunya virus infection cases was investigated for each of the country thus identified. All the official published data was taken into account, whether published in magazines, non-standard scientific publications for specialists, or presented in symposia.

The collected data concerned surveillance methods, epidemiological data, epidemic kinetics, complementary studies eventually performed and especially, seroprevalence studies, surveillance methods and results in inter-epidemic periods.

When it was documented, epidemic kinetics was compared by using normalized representation by a square root transformation of the weekly number of cases in various countries reported on a single time scale.

In the Reunion Island, surveillance was based on active screening in moderate incidence periods and on estimation from reports by sentinel physicians during the epidemic peak. Studies performed independently at various epidemic periods were used as external validity control of data provided by the surveillance set-up: National Institute for Health and Medical Research (Institut National de la Santé et de la Recherche Médicale Inserm) seroprevalence study of pregnant women sera [27], Ipsos telephone survey (results not published), seroprevalence study performed by Inserm during the epidemic [28].

A prospective surveillance of mortality was made from death certificates mentioning chikungunya received by the Regional health and social affairs services (Direction régionale des affaires sanitaires et sociales, Drass) as well as a comparative analysis of observed compared to expected mortality [29]. Surveillance of severe presentations was done with an active prospective and retrospective system implemented by the Regional Epidemiological Investigation Group (Cire RM) in various hospitals from identified medical files. Since April 19, 2007, date on which the public authorities announced passage to an inter-epidemic period, surveillance has been based on laboratories notification of any biological result compatible with a recent infection.

In Mayotte, a passive notification system was set up, relying on physicians, completed by a prospective screening of severe hospital presentations. This system was completed by two surveys: a seroprevalence study from frozen serum samples collected from pregnant women in October 2005 and in March & April 2006 [30] and a clinical study in the community performed in May 2006 on a representative sample of Mayotte population [30]. Finally, a post-epidemic seroprevalence study was performed in November 2006 on a representative sample of Mayotte population [31]. No specific surveillance system of chikungunya related deaths was set up in Mayotte. An active and prospective data collection of severe hospital presentations has been made from January 2006 by the epidemiological surveillance unit of the Mayotte hospital center. At the end of 2008, a similar system to the one set up in the Reunion Island was implemented and on the Cire RM's request, it included surveillance for Rift valley fever and leptospirosis in addition to dengue fever and chikungunya.

3. Results

Beginning in May 2004, a chikungunya epidemic affected the Kenyan coast, first observed on the island of Lamu where the epidemic peak was reached in July 2004. The epidemic then spread to the port city of Mombasa between November and December 2004. A cross-sectional seroprevalence study performed