



# Atypical Chikungunya during pregnancy: Report of the Venezuela final experience

Ana Carvajal <sup>\* 1, 2</sup>, Susana Gómez <sup>2</sup>, Lía Monsalve-Arteaga <sup>1, 3</sup>, Lyaduvina Caraballo <sup>3</sup>, Ana Agüero <sup>3</sup>, Ricardo Strauss <sup>4</sup>, Olga Rojas <sup>5</sup>, Mabel Palmero <sup>6</sup>, Aleydah Salazar <sup>7</sup>, Clara Pacheco <sup>8</sup>, Gidder Benítez <sup>7</sup>, Alfonso J. Rodríguez-Morales <sup>9, 10</sup>

## ABSTRACT

### Introduction

Chikungunya virus (CHIKV) is an emerging arbovirus in Latin America and the Caribbean. The virus was detected in the Caribbean territory, at the end of 2013 for the first time. It is known that 1 to 2 % of patients will show atypical symptoms.

### Methods

Three cases of pregnant women with atypical Chikungunya virus are described taking into account epidemiological variables, clinical features, pregnancy progress and laboratory testing parameters.

### Results

Three pregnant women with atypical CHIKV confirmed by RT-PCR were included. All of them were included at the ICU because of a life-threatening disease, 2 of the pregnancies were resolved by caesarean, one at term with a newborn with typical CHIKV and the other one at the 25 week of pregnancy, this result in a stillborn and a neonatal death.

### Conclusion

Chikungunya fever during pregnancy can show atypical and severe course, with adverse evolution of pregnancy and vertical transmission of the infection. We recommend to maximize the medical care in pregnant women with suspicion of CHIKV infection.

**Keywords:** Chikungunya, Pregnancy, Atypical Chikungunya, Chikungunya Outbreak

## INTRODUCTION

Chikungunya virus (CHIKV) is an emerging arbovirus in Latin America and the Caribbean.<sup>1</sup> This virus cause Chikungunya fever characterize by sudden high fever and joint symptoms that can be severe. In general, 1 to 2% of cases can show atypical signs with a range of severity.<sup>2</sup>

The most vulnerable groups are the elderly, patients with comorbidities, newborns and pregnant women.<sup>3</sup>

GJMEDPH 2017; Vol. 6, issue 3

<sup>1</sup>Servicio de Enfermedades Infecciosas del Adulto Hospital Universitario de Caracas- Universidad Central de Venezuela, Caracas, Venezuela

<sup>2</sup>Servicio de Medicina Interna – Policlínica las Mercedes – Caracas, Venezuela

<sup>3</sup>Centro de Investigación en Enfermedades Tropical, Universidad de Salamanca, Salamanca, España

<sup>4</sup>Instituto de Medicina Tropical, Bernhart Nocht, Hamburgo, Alemania

<sup>5</sup>Servicio de Ginecología y Obstetricia – Policlínica las Mercedes – Caracas, Venezuela

<sup>6</sup>Servicio de Servicio de Cuidados Intensivos Neonatales, Policlínica las Mercedes – Caracas, Venezuela

<sup>7</sup>Servicio de Servicio de Ginecología y Obstetricia, Hospital Universitario de Caracas

<sup>8</sup>Servicio de Unidad de Cuidados Intensivos, Hospital Universitario de Caracas – Universidad Central de Venezuela

<sup>9</sup>Servicio Grupo de Investigación en Infecciones y Salud Pública, Facultad de Ciencias de la Salud, Universidad Tecnológica de Pereira, Pereira, Risaralda, Colombia

<sup>10</sup>Servicio Red Colombiana de Investigación en Zika y otras arbovirosis (RECOLZIKA), Pereira, Risaralda, Colombia

### \*Corresponding Author

Ana Carvajal  
Servicio de Enfermedades Infecciosas del Adulto Hospital Universitario de Caracas- Universidad Central de Venezuela, Caracas, Venezuela

**Conflict of Interest**—none

**Funding**—none

It is transmitted by the bite of the *Aedes* mosquito. Other transmission ways are perinatal, occupational and potentially through transfusions.<sup>4-6</sup>

There is still lack of evidence regarding vertical transmission of CHIKV in Latin America. However, up to date 180 cases within 5 countries have been reported.<sup>7-10</sup>

## GOAL

To analyze clinical and laboratory testing features and the evolution of 3 pregnant women with confirmed severe atypical Chikungunya.

## METHODS

Three particular cases of pregnant women with atypical Chikungunya are described (table 1) taking into account epidemiological variables, clinical features, pregnancy progress and laboratory testing parameters. All of them were received in the setting of Chikungunya Fever epidemic in Venezuela during 2014.

RT-PCR was carried out for the diagnosis in the National Institute of Hygiene "Rafael Rangel". Serology for Dengue and HIV, and immunologic tests were carried out in order to discard other diseases.

## RESULTS

### Case 1

A 24 years old pregnant woman (first pregnancy), 37 pregnancy weeks plus 6 days. 4 days previous to admission noticed malaise, fever 39.00°C, bilateral arthralgia in ankles, edema and pain on both plantar areas and abdominal rash. 24 hours after admission suddenly showed tachypnea, hypoxia (SO<sub>2</sub>: 67%), tachycardia (130 ppm), hypotension, and retrosternal pain. The EKG reported sinus tachycardia. The Cardiac enzymes were normal. The patient was transferred to the Intensive Care Unit (ICU) and Caesarea was carried out. Immediately after the procedure the symptoms disappear. The newborn presented symptoms of typical chikungunya at the second day of birth

### Case 2

A 25 years old pregnant woman (second pregnancy), 25 weeks of multiple pregnancy. The patient is admitted with premature delivery threat, urinary

infection, fever and generalized arthralgia. The next day the patient showed frequent uterine contractions resistant to Fenoterol. The patient is treated with Magnesium Sulfate and suddenly showed tachypnea, tachycardia, neurologic failure (stupor and agitation), retrosternal pain and hypoxia.

An emergency Caesarea is carried out obtaining a stillborn and a newborn with neonatal death in 48 hours. The patient is transferred to other health center to be admitted in ICU where needed mechanical ventilation during 72 hours. The patient is discharge afterwards in good conditions.

### Case 3

A 19 years old pregnant woman (second pregnancy), with 20 pregnancy weeks. Is admitted because of fever. The next day showed rash and pruritus in abdomen and lower limbs, generalized arthralgia and arthritis in interphalangeal joints of both hands, wrists (Figure 1) and ankles. Also bilateral edema (Figure 2) making impossible to walk. Laboratory testing showed anemia, leukocytosis and neutrophilia.

14 days after admission showed dyspnea, tachycardia and bilateral pleural effusion. Is admitted in ICU during 10 days where differential diagnosis sepsis and immune-rheumatologic disease were ruled out. While waiting for culture results empiric antimicrobial therapy with Vancomycin and Meropenem was started.

The patient was discharged after 33 days of hospitalization in good conditions, with 24 + 6 days of pregnancy and a healthy fetus.

Table 1 shows the clinical and laboratory characteristics and the evolution of pregnancy in the three cases.

CHIKV diagnosis was confirmed in all patients through genomic identification of the virus using RT-PCR. Serology for dengue, VDRL, CMV and HIV were negative in all cases. Also all the bacterial cultures were negatives.



**Fig 1 Generalized Arthralgia and Arthritis in Interphalangeal Joints of Both Hands and Wrists**



**Fig 2 Bilateral Edema**

Table 1 Characteristics of the Patients with Chikungunya

Cases	Age	Pregnancy weeks	Symptoms	Cardiac and respiratory maternal symptoms	Pregnancy progress	Vertical transmission / Newborn progress	Test CHIKV	Other Tests
Nº 1	24	37	Arthralgia in ankles, edema and bilateral plantar pain, abdominal rash.	Tachycardia, dyspnea, hypotension, thorax pain, and hypoxia. Admitted in ICU 48 hours.	At term (Caesarea)	Newborn with typical CHIKV (RT-PCR for VCHIK not available)	RT-PCR positive	Leucopenia, lymphocytosis. EKG: sinus tachycardia. Normal cardiac enzymes.
Nº 2	25	25	Fever, generalized mio-arthralgias.	Dyspnea, tachycardia, neurological failure, retrosternal pain and hypoxia. Admission in IUC during 3 days.	Preterm (Caesarea)	Newborns (twin pregnancy) preterm, a stillborn and a newborn who died in 48 hours. (RT-PCR for CHIKV not available).	RT-PCR Positive	Leucopenia. EKG: sinus tachycardia. Normal cardiac enzymes.
Nº 3	19	20	Fever, maculopapular rash, arthritis in both hands, wrists, toes of both feet and ankles.	Tachycardia, dyspnea and serositis. Admission in ICU during 10 days.	Without obstetric complications.	Discharge at day 33th, ulterior progression of pregnancy unknown.	RT-PCR Positive	Leukocytosis with neutrophilia. C protein reactive, VSG, hepatic enzymes and DHL increased. Thrombocytopenia and immunologic tests: negative. EKG: sinus tachycardia.

## DISCUSSION

Chikungunya fever is an emerging arbovirosis in the Americas which is caused by the homonymous virus. The word Chikungunya comes from the Makonde language which means "to get dry or to get buckled", due to the bended habitus of the patients because of the pain.<sup>12</sup> It was identified for the first time in Tanzania during 1952 – 1953.<sup>13</sup>

The virus was detected in the Caribbean territory, at the end of 2013 for the first time, specifically in the San Martin Island on its French part<sup>14</sup> and it was rapidly spreaded to other Caribbean islands and the Americas, happening to meet its presence with the areas of the transmitter vectors, the *Aedes spp.* Mosquitoes.<sup>14, 15</sup>

According to the Pan American Health Organization (PAHO), during 2014, 1.071.696 cases were detected in the Americas, while 169 died.<sup>16</sup> The first autochthonous case in Venezuela, was reported in June 2014.<sup>17</sup> Until the 51th epidemic week in 2014, Venezuela reported 34.642 suspected cases while 2303 confirmed to the PAHO (PAHO). This data differs from the one estimated by Public Health Venezuelan specialists (*Defendamos la epidemiología* network and Venezuelan Society of Public Health); which estimated almost 3 million cases of CHIKV in our country.<sup>18</sup>

Studies on Chikungunya Fever during pregnancy were carried out during the first epidemic in the

Reunion Island in 2006, and showed similar clinical features between this group and non pregnant population.<sup>19</sup>

Out of 658 pregnant women infected with CHIKV, the most frequent signs and symptoms were: Fever (62%), arthralgia (93%), cephalgia (54%), edema (54%), diarrhea (12%), aphthous ulcers (9.6%), epistaxis or gingivorragia (9.0%) and rash (76%). In total, 137 (21%) were admitted with a mean of 2 days of inpatient permanence (range 1-75 days), atypical manifestations were not described.<sup>19</sup>

Atypical symptoms of Chikungunya fever are shown in a low proportion of patients and they have a wide spectrum. Ulterior series have described: encephalitis, seizures, myocarditis, pericarditis, heart failures, renal failure, respiratory failure, ocular affection (episcleritis, granulomatous and non granulomatous uveitis, etc.), hyperpigmentation and epidermolysis bullosa, among others.<sup>2, 20-30</sup>

Reports on atypical Chikungunya in pregnant women is limited. This study represents the first case series of atypical and severe presentation of Chikungunya during pregnancy in Venezuela.

The cases 1 and 2 showed similar clinical features: tachycardia, dyspnea, retrosternal pain. The case 3 also showed tachycardia and dyspnea apart from other already mentioned symptoms. The newborn of the case 1 showed clinical features of typical Chikungunya fever, with generalized maculopapular rash and fever.

Vertical transmission of CHIKV was demonstrated for the first time in the epidemic in the Reunion Island in 2005-2006, where the rate was low. However, vertical transmission rates up to 48.7% can be seen when the acute infection occurred during the peripartum, particularly when the mother acquired CHIKV in the last week before the delivery.<sup>19, 24</sup>

In Colombia, at the Sucre department (state), the first report of 8 babies with a confirmed perinatal-acquired CHIKV (either documented with RT-PCR and/or serology) was published in August 2015.<sup>8</sup>

A few months later, at the Santander department (state), one additional case reported residual psychomotor sequelae after 12-month follow up.<sup>25</sup> In July 2016, two other cases were documented (with RT-PCR confirmation both in serum and urine) in Salvador, Brazil.<sup>9, 10</sup>

In these case series, as well as in others,<sup>8-10, 25</sup> the attention was focus to life-threatening complications requiring support of vital functions in the neonatal intensive care unit, such as meconium-stained aspiration pneumonia, sepsis, necrotizing enterocolitis, severe respiratory distress, myocardiopathy, encephalopathy or bullous dermatosis.

In September 2016, the first initiative of data sharing about the topic was published as a multicenter study conducted in four large regional maternity units from three different countries in Latin America.<sup>26</sup> The report included 169 newborns observed in El Salvador, Colombia and Dominican Republic. The clinical presentations presumably due to the Asian lineage of CHIKV were consistent with those previously reported from Reunion Island with a lower incidence of neurological disease but a higher case fatality rate than expected with the Indian-Ocean lineage.<sup>7</sup>

Recently in Puerto Rico ten additional cases were reported,<sup>27</sup> which summarizes the Western Hemisphere experience with at least 180 published cases gathered from 5 countries.

Chikungunya fever, is different to Zika virus because it has not been associated with congenital malformations. However, there are some reports of cognitive illnesses in newborns with atypical presentation of the disease.<sup>28</sup>

The case 2 showed premature delivery with stillborn and neonatal death, probably associated with severity of the disease (hypoxia, tachycardia, dyspnea). Chikungunya fever can cause abortion and premature delivery,<sup>29</sup> on the other hand the prematurity is an important cause of neonatal death. The case 3 showed persistence of the symptoms (arthralgia, fever and rash), probably mediated by the



increase of interleukins IL-1 $\beta$ , IL-6 and decrease of RANTES, which have been related to severe presentation.<sup>30</sup> This patient showed clinical features and laboratory parameters that have been described in atypical and severe CHIKV cases<sup>20</sup> like dyspnoea, tachycardia, serositis, leucocytosis, anaemia, thrombocytopenia, and high hepatic enzymes. Due to high levels of LDH plus the findings mentioned, HELLP syndrome was suggested initially. This condition can be diagnosed with biochemical markers, although some experts require the presence of severe pre-eclampsia plus the biochemical markers.<sup>31</sup> This patient didn't show hypertension and the progress of the pregnancy during the hospitalization was normal and pregnancy was not interrupted.

The differential diagnosis of atypical CHIKV in pregnancy include severe Dengue, severe Zika, Mayaro Fever, cytomegalovirus acute infection, acute Chagas, Malaria, viral Hepatitis, sepsis, other causes of cardiac diseases, HELLP syndrome and eclampsia, among others.<sup>31-36</sup>

In this study the diagnosis of all cases was confirmed with RT-PCR, which must be carried out the first 5-6 days of the disease. After the viremia phase other serologic tests more accessible like ELISA can be used. However, the essays for the detection of antibodies like ELISA test are not recommended during the acute phase.<sup>37</sup>

The medical care of pregnant women with atypical CHIKV is complex, and require multidisciplinary attention, including infectious diseases specialists, internists, obstetricians and intensivists.

## CONCLUSION

Chikungunya fever during pregnancy can show atypical and severe course, with adverse evolution of pregnancy and vertical transmission of the infection. We recommend to maximize the medical care in pregnant women with suspicion of CHIKV infection. This is the first report of pregnant women with atypical Chikungunya in Venezuela.

## REFERENCES

1. Cauchemez S, Ledrans M, Poletto C, Quenei P, de Valk H, Colizza V, et al. Local and regional spread of chikungunya fever in the Americas [Internet]. 2014 [cited 2017 Feb 8]. Available from: <http://www.eurosurveillance.org/ViewArticle.aspx?ArticleId=20854>
2. Economopoulou A, Dominguez M, Helynck B, Sissoko D, Wichmann O, Quenel P, et al. Atypical Chikungunya virus infections: clinical manifestations, mortality and risk factors for severe disease during the 2005-2006 outbreak on Réunion. *Epidemiol Infect.* 2009 Apr;137(4):534-41.
3. Centers for Disease Control and Prevention, Pan American Health Organization. Preparación y respuesta ante la eventual introducción del virus chikungunya en las Américas [Internet]. [cited 2017 Feb 8]. Available from: [http://www1.paho.org/hq/dmdocuments/CHIKV\\_Spanish.pdf](http://www1.paho.org/hq/dmdocuments/CHIKV_Spanish.pdf)
4. Carvajal A. Fiebre chikungunya. *Gac Méd Caracas.* 2013;29(4):198-211.
5. Liunbruno GM, Calteri D, Petropulacos K, Mattivi A, Po C, Macini P, et al. The Chikungunya epidemic in Italy and its repercussion on the blood system. *Blood Transfus.* 2008 Oct;6(4):199-210.
6. Simon F, Savini H, Parola P. Chikungunya: a paradigm of emergence and globalization of vector-borne diseases. *Med Clin North Am.* 2008 Nov;92(6):1323-1343, ix.
7. Torres JR, Falleiros-Arlant LH, Dueñas L, Pleitez-Navarrete J, Salgado DM, Castillo JB-D. Congenital and perinatal complications of chikungunya fever: a Latin American experience. *Int J Infect Dis IJID Off Publ Int Soc Infect Dis.* 2016 Oct;51:85-8.
8. Villamil-Gómez W, Alba-Silvera L, Menco-Ramos A, Gonzalez-Vergara A, Molinares-Palacios T, Barrios-Corrales M, et al. Congenital Chikungunya Virus Infection in Sincelejo, Colombia: A Case Series. *J Trop Pediatr.* 2015 Oct;61(5):386-92.
9. Lyra PPR, Campos GS, Bandeira ID, Sardi SI, Costa LF de M, Santos FR, et al. Congenital Chikungunya Virus Infection after an Outbreak in Salvador, Bahia, Brazil. *AJP Rep.* 2016 Jul;6(3):e299-300.
10. Lyra PPR, Campos GS, Bandeira ID, Sardi SI, de Moura Costa LF, Santos FR, et al. Erratum: Congenital Chikungunya Virus Infection after an

- Outbreak in Salvador, Bahia, Brazil. *AJP Rep.* 2016 Jul;6(3):e324.
11. Carvajal A, Monsalve L, Figueredo A, Villarroel E, Salazar A, Pacheco C, et al. Enfermedad parecida a chikungunya en 12 embarazadas del Hospital Universitario de Caracas (HUC) Venezuela. Año 2014. 2016 Dec;124(4):316–21.
  12. Lumsden WH. An epidemic of virus disease in Southern Province, Tanganyika Territory, in 1952-53. II. General description and epidemiology. *Trans R Soc Trop Med Hyg.* 1955 Jan;49(1):33–57.
  13. Robinson MC. An epidemic of virus disease in Southern Province, Tanganyika Territory, in 1952-53. I. Clinical features. *Trans R Soc Trop Med Hyg.* 1955 Jan;49(1):28–32.
  14. World Health Organization. Chikungunya in the French part of the Caribbean isle of Saint Martin [Internet]. [cited 2017 Feb 8]. Available from: [http://www.who.int/csr/don/2013\\_12\\_10a/en/](http://www.who.int/csr/don/2013_12_10a/en/)
  15. Weaver SC, Lecuit M. Chikungunya virus and the global spread of a mosquito-borne disease. *N Engl J Med.* 2015 Mar 26;372(13):1231–9.
  16. Pan American Health Organization. Número de casos reportados de fiebre chikungunya en las Américas - Semana Epidemiológica 52 [Internet]. 2014 [cited 2017 Feb 8]. Available from: [http://www.paho.org/hq/index.php?option=com\\_docman&task=doc\\_view&gid=28698&Itemid=270](http://www.paho.org/hq/index.php?option=com_docman&task=doc_view&gid=28698&Itemid=270)
  17. Venezuela registra el primer caso del virus chikungunya. *Diario Libre* [Internet]. 2014 Jun 6 [cited 2017 Feb 8]; Available from: <http://www.diariolibre.com/noticias/venezuela-registra-el-primer-caso-del-virus-chikungunya-CKDL642891>
  18. Oletta J. Epidemia de fiebre chikungunya en Venezuela, 2014-2015. *Gac Méd Caracas.* 2016;124(2):122–37.
  19. Gérardin P, Barau G, Michault A, Bintner M, Randrianaivo H, Choker G, et al. Multidisciplinary prospective study of mother-to-child chikungunya virus infections on the island of La Réunion. *PLoS Med.* 2008 Mar 18;5(3):e60.
  20. Torres JR, Córdova L, Castro JS, Rodríguez L, Saravia V, Arvelaez J, et al. Chikungunya fever: Atypical and lethal cases in the Western hemisphere: A Venezuelan experience. *IDCases.* 2015;2(1):6–10.
  21. Mendoza I, Morr I, Mendoza I, Morr C, Morr C, Meza Y, et al. Chikungunya Myocarditis: An Emerging Threat to America. In San Diego, California; 2015 [cited 2017 Feb 8]. Available from: <http://www.abstractsonline.com/pp8/#!/3658/presentation/33149>.
  22. Obeyesekere I, Hermon Y. Myocarditis and cardiomyopathy after arbovirus infections (dengue and chikungunya fever). *Br Heart J.* 1972 Aug;34(8):821–7.
  23. Simon F, Paule P, Oliver M. Chikungunya virus-induced myopericarditis: toward an increase of dilated cardiomyopathy in countries with epidemics? *Am J Trop Med Hyg.* 2008 Feb;78(2):212–3.
  24. Robillard P-Y, Boumahni B, Gérardin P, Michault A, Fourmaintraux A, Schuffenecker I, et al. Vertical maternal fetal transmission of the chikungunya virus. Ten cases among 84 pregnant women. *Presse Medicale Paris Fr* 1983. 2006 May;35(5 Pt 1):785–8.
  25. Alvarado-Socarras JL, Ocampo-González M, Vargas-Soler JA, Rodríguez-Morales AJ, Franco-Paredes C. Congenital and Neonatal Chikungunya in Colombia. *J Pediatr Infect Dis Soc.* 2016 Sep;5(3):e17-20.
  26. Rodríguez-Nieves M, García-García I, García-Fragoso L. Perinately Acquired Chikungunya Infection: The Puerto Rico Experience. *Pediatr Infect Dis J.* 2016 Oct;35(10):1163.
  27. Rodríguez-Nieves M, García-García I, García-Fragoso L. Perinately Acquired Chikungunya Infection: The Puerto Rico Experience. *Pediatr Infect Dis J.* 2016 Oct;35(10):1163.
  28. Gérardin P, Sampériz S, Ramful D, Boumahni B, Bintner M, Alessandri J-L, et al. Neurocognitive outcome of children exposed to perinatal mother-to-child Chikungunya virus infection: the CHIMERE cohort study on Reunion Island. *PLoS Negl Trop Dis.* 2014 Jul;8(7):e2996.
  29. Simon F, Javelle E, Oliver M, Leparç-Goffart I, Marimoutou C. Chikungunya virus infection. *Curr Infect Dis Rep.* 2011 Jun;13(3):218–28.
  30. Ng LFP, Chow A, Sun Y-J, Kwek DJC, Lim P-L, Dimatatac F, et al. IL-1 $\beta$ , IL-6, and RANTES as biomarkers of Chikungunya severity. *PLoS One.* 2009;4(1):e4261.
  31. Haram K, Svendsen E, Abildgaard U. The HELLP syndrome: clinical issues and management. *A Review. BMC Pregnancy Childbirth.* 2009 Feb 26;9:8.
  32. Machado CR, Machado ES, Rohloff RD, Azevedo M, Campos DP, de Oliveira RB, et al. Is pregnancy associated with severe dengue? A review of data

- from the Rio de Janeiro surveillance information system. *PLoS Negl Trop Dis*. 2013;7(5):e2217.
33. Torres JR, Russell KL, Vasquez C, Tesh RB, Salas R, Watts DM. Family Cluster of Mayaro Fever, Venezuela. *Emerg Infect Dis*. 2004 Jul;10(7):1304–6.
  34. Kovacs SD, Rijken MJ, Stergachis A. Treating severe malaria in pregnancy: a review of the evidence. *Drug Saf*. 2015 Feb;38(2):165–81.
  35. Cordioli RL, Cordioli E, Negrini R, Silva E. Sepsis and pregnancy: do we know how to treat this situation? *Rev Bras Ter Intensiva*. 2013 Dec;25(4):334–44.
  36. Carvajal A, Ortiz A, Hernández M, Puche D, Pérez Wulf J, Larrazabal N, et al. Consenso de infecciones en embarazadas. *Bol Venez Infectol*. 2014;25(2):67–117.
  37. Blacksell SD, Tanganuchitcharnchai A, Jarman RG, Gibbons RV, Paris DH, Bailey MS, et al. Poor Diagnostic Accuracy of Commercial Antibody-Based Assays for the Diagnosis of Acute Chikungunya Infection ▽. *Clin Vaccine Immunol CVI*. 2011 Oct;18(10):1773–5.