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## High Dose Intravenous Vitamin C and Chikungunya Fever: A Case Report

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### Abstract

The Chikungunya (CHIKV) fever is a viral disease produced by a single-stranded RNA Alphavirus from the Togaviridae genus. Its transmission occurs only through mosquito vectors, principally *Aedes aegypti*. It requires a human-mosquito-human transmission cycle. It is associated with severe arthritis/arthralgias, myalgias, high fever, headache, and maculopapular rash. Joint ache appears to be symmetrical. The virus has an incubation period of 2 to 7 days, where the high fever is typically presented. It is followed by arthralgias and myalgias, and rashes, which last for 3 to 5 days. However, the arthralgias can persist for months after the infection, which can contribute to severe arthritis. As of now, no vaccine exists for the virus and no official treatment has been developed aside from standard procedures of the use of acetaminophen (paracetamol), and non-steroidal anti-inflammatory drugs. This is a case report of a 54-year old Hispanic individual that reported left shoulder pain, left knee pain and fever. The symptoms started on a Saturday in September 2014 in middle of the night. The patient was treated with high doses of intravenous vitamin C over two days. The symptoms resolved after the infusions without any side effects. Based on the positive outcome in this case, we propose that intravenous vitamin C should be studied further as a potential treatment for acute viral infections.

### Introduction

The Chikungunya virus (CHIKV) is a single-stranded RNA Alphavirus from the Togaviridae genus.<sup>1</sup> It was first isolated in humans in 1952 in Tanzania. Its transmission occurs only through mosquito vectors, principally *Aedes aegypti*. It requires a human-mosquito-human transmission cycle. Over the years, it has been ignored as a potential threat,

#### Competing Interests

The authors declare that they have no competing interests.

mostly affecting developing countries. At this moment, no vaccine exists for the virus and no official treatment has been developed aside from the standard procedures of the use of paracetamol or acetaminophen, and non-steroidal anti-inflammatory drugs for symptom control.<sup>2</sup> Infection with chikungunya virus is rarely fatal, but the joint pain can often be severe and debilitating. The acute phase of the infection usually last 5 to 7 days. A temporary slight improvement is often followed by pain of moderate to severe intensity that can lead to temporary disability.

The virus mainly affects the human endothelial and epithelial cells known as fibroblasts. These fibroblasts usually make up the muscle and joint tissue. As the infection progresses, these fibroblasts are damaged and epithelial and endothelial cells die. The injury to the fibroblasts results in muscle and joint pain.

For many years, it has been widely known that ascorbic acid (vitamin C) has a variety of functions with clinical efficacy. It is a water-soluble antioxidant, and has been used to prevent many diseases or infections like the common cold and other viral infections.<sup>3-6</sup> Ascorbic acid scavenges reactive oxygen species (ROS), increases vascular and connective tissue integrity, improves immune function, and assists in leukocyte phagocytic functions.<sup>7</sup>

Vitamin C supplemented orally has its limitations in achieving high blood (i.e., plasma) levels, whereas the use of intravenous vitamin C (IVC) can reach blood levels that possess distinct clinical and pharmacological advantages. Vitamin C is absorbed in the gastrointestinal tract, where the body metabolizes a limited amount and the rest is excreted through the kidneys.<sup>8</sup> However, if the vitamin is administered intravenously it can reach plasma concentrations that are 30 to 70 times higher than the oral pathway.

Ascorbic acid is also a nutrient for the immune system. Treatment of ascorbic acid in vitro resulted in an increase in T-cells and natural killer (NK)-cells, which constitute one of the main components of the adaptive immune system which fights against viruses and intracellular bacteria.<sup>3</sup> It has been suggested the same effect can be achieved by IVC administration.

Here we report a case of Chikungunya fever, treated with high doses (100g/day) of IVC in a period of two days and without any side effects.

## Case Report Presentation

This is a case of a 54-year old Hispanic individual who reported severe arthralgia, left shoulder pain, left knee pain as well as a maculopapular rash and a high fever. The symptoms started on a Saturday in September 2014 a few hours before dawn. Next day the patient had a lab test for Chikungunya and dengue. He eventually was found to be positive for Chikungunya via an elevated immunoglobulin M (i.e., IgM) titre. The patient was treated with high doses of IVC (100g/day) for a duration of two days. In relation to lab parameters before treatment, the only abnormality was an extremely large increase in C-reactive protein/CRP (26.9 mg/L). This CRP measure after treatment was reduced to 15.8 mg/L. The symptoms of pain, fever, and rash resolved after the infusions without any side effects. The symptoms improved substantially in 24 hours and were absent the next day.

## Discussion

Growing evidence has suggested a close correlation between oxidative stress and viral infectious disease.<sup>9</sup> The elevated oxidants induced by viral infection include nitric oxide radicals, superoxide anions, hydroxyl radicals and their by-products (such as hydrogen peroxide), which may all contribute to viral pathogenesis, the modulation of cellular responses, and the regulation of viral replication and the host defense.<sup>9</sup> Many of these oxidants may be harmful to the host cells if they are released into the extracellular medium.<sup>10,11</sup>

Vitamin C is an efficient antioxidant, and possesses anti-viral activity. For example, it has been shown that vitamin C is an essential factor in the production of the anti-viral immune response during the early phase of viral infection through the production of type I interferons, which up-regulates NK cell and cytotoxic T-lymphocyte activity.<sup>12</sup> Also, studies have indicated that ascorbic acid can be used as an inactivating agent for both RNA and DNA viruses, affecting viral infectivity.<sup>5</sup> In addition, ascorbic acid can detoxify viral products that produce pain and inflammation.<sup>6</sup> All this evidence confirms the effectiveness of ascorbic acid against viral infections, and Chikungunya fever, as suggested by the patient's swift response to IVC. Furthermore, no side effects resulted during or after the treatment. Based on the positive outcome in this case, we propose that IVC should be studied further as a potential treatment for acute viral infections.

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