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Letter to the editor

Carpal tunnel syndrome observed after an arbovirus infection: A preliminary case series report

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ABSTRACT

Purpose: Report a case series study of individuals who, after having a suspected arboviral disease during an epidemic outbreak in north-eastern Brazil, presented symptoms of acroparesthesia.
Methods: A retrospective evaluation of patients with acroparesthesia undertaken between December 2015 and October 2016 following a clinical picture suggestive of an arboviral infection.
Results: Clinical and electrophysiological data were obtained from 29 individuals. 13% were male. All presented a main complaint of numbness in the hands, with 86% presenting bilateral symptoms. The symptoms started within 60 days of the clinical picture in 62% of cases. The electrophysiological study demonstrated CTS in 54 median nerves. It was classified as mild in 24.1% of cases, moderate in 32.7%, severe in 24.1%, very severe in 6.8% and extremely severe in 5.1%.
Conclusion: The best explanation for the presence of acroparesthesia following an arboviral infection may be the narrowing of the carpal tunnel caused by the inflammatory joint process usually observed in cases of chikungunya infection.
Clinical relevance: This is the first study with electrophysiological data that associates arboviral infection with CTS.

1. Introduction

Acroparesthesias are complaints often reported by individuals with median compressive neuropathy at the level of the carpal tunnel. Carpal tunnel syndrome (CTS) is the most prevalent compressive neuropathy, and usually presents with pain and paresthesia, especially in the middle and index fingers, which worsen during the night [1]. When compression is accentuated, motor signals are usually present, and thenar atrophy may occur due to axonal degeneration. CTS is a result of the narrowing of the carpal tunnel, anteriorly composed of the transverse ligament, medially by the pisiform and the hook of the hamate, and laterally by the scaphoid and medial trapezium. In addition to familial predisposition, clinical conditions such as diabetes, osteoarthritis, amyloidosis, post-trauma and obesity may be associated with CTS. Infectious diseases have also been implicated as the cause of CTS, including bacterial and viral causes [1].

Outbreaks of arbovirus infection have been described in several countries in the Americas, especially in Brazil, since 2013 [2–4]. Dengue, Zika and chikungunya are diseases caused by arboviruses transmitted by the same vector, the mosquito *Aedes aegypti*. In Brazil, outbreaks of dengue have been reported for more than two decades [3], and since 2015 cases of Zika virus have been reported in Natal, in north-eastern Brazil [3,4], and cases of chikungunya have been reported in several countries in South America, including Brazil. Although the clinical picture is very similar between these three diseases, chikungunya and Zika virus have demonstrated potential neurological impairment associated with the general clinical picture of fever, cutaneous rash, myalgia, headache and arthralgia [2,5]. In cases of chikungunya, persistent and lasting arthralgia has been reported [5,6]. Some authors have reported extensive involvement of the nervous system during infection by these agents [3,4]. Guillain-Barre syndrome (GBS), myelitis, facial paresis and encephalitis have been reported in some patients with arboviruses [3,4].

Since 2014, there has been an epidemic of arboviruses in north-eastern Brazil, mainly caused by the Zika and chikungunya viruses [2]. From this time, reports of neurological complications have been described [2–4]. Thus, we will describe a case series of patients who presented complaints of pain and paresthesia in the hands after having a clinical condition compatible with infection by an arbovirus, in a region with a widespread epidemic outbreak.

2. Material and methods

2.1. Sample

This is a retrospective study which analysed the data collected from all patients with complaints of recent onset of acroparesthesia who were referred to an electrophysiology laboratory to undergo electromyography in the period from December 2015 to October 2016. This laboratory is one of three in the State. The patient's personal data and medical history were collected, and a clinical evaluation was performed by a neurologist with experience in neuromuscular diseases. Following this, the patients underwent electrophysiological examination with a Nicolet Viking Quest version 10 EMG. The institution does not require IRB approval. It is a retrospective study by medical records, motivated by the observation of the increase in cases of CTS individuals who had arboviruses.

There were 89 individuals recorded with complaints of acroparesthesia after viral infection, with strong clinical suspicions of arboviruses. Of these, 22 were excluded because they were diabetic, 27 because they reported nocturnal paresthesias in the hands prior to arbovirus infection, 7 because they presented intense thenar atrophy

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Table 1
Electrophysiology data.

Side	Median (M)			Ulnar (M)			Median (S) (Palm-Wrist)			Median (S) (II finger-wrist)			Ulnar (S)			Wave
	Lat	Amp	Vel	Lat	Amp	Vel	Lat	Amp	Vel	Lat	Amp	Vel	Lat	Amp	Vel	
W	3.8	7.5	62	1.9	11.5	59	2.3	20	34	3.4	30	41	1.7	46	69	24.7
L	2.9	10.8	58	1.8	12.1	57	1.6	46	50	2.8	51	50	1.8	51	70	No
W	4.2	6.0	54	2.0	8.2	60	2.5	4	32	3.4	22	41	1.5	47	80	25.3
L	3.4	5.9	50	2.1	8.6	56	2.3	15	35	3.7	14	38	1.8	46	65	No
W	6.4	5.6	61	2.1	9.0	60	No	No	No	4.6	7	30	1.8	36	67	25.6
L	4.4	10.3	55	2.3	7.8	61	2.6	11	31	4.0	16	35	1.8	40	67	26.3
W	5.3	7.8	48	2.1	14.7	57	2.5	21	32	3.5	38	40	1.8	58	67	25.6
L	3.7	9.5	55	1.9	12.3	60	1.9	33	42	2.9	52	48	1.9	72	65	25.4
W	3.3	12.3	53	2.3	6.5	54	1.8	25	43	2.8	25	50	2.3	20	54	27.5
L	3.3	11.5	55	2.3	5.9	51	1.7	79	47	2.9	30	48	2.2	20	57	28.0
W	4.7	9.6	55	2.4	7.0	58	No	No	No	3.3	20	42	2.1	27	57	27.8
L	4.8	8.7	55	2.3	6.7	50	2.8	5	29	3.7	17	38	2.0	30	63	27.8
W	5.4	3.5	51	2.2	9.1	55	No	No	No	No	No	No	2.1	12	58	28.0
L	6.6	5.7	52	2.2	9.1	53	No	No	No	No	No	No	2.0	16	61	No
W	5.0	4.0	51	2.2	6.1	No	No	No	No	3.9	6	36	1.8	15	69	26.5
L	4.1	5.2	47	2.1	7.0	55	2.2	13	36	3.4	14	41	1.8	23	67	26.1
W	4.7	6.3	51	2.1	6.7	54	2.5	10	32	3.4	16	41	1.8	28	67	27.1
L	4.2	5.2	50	2.1	7.9	55	2.2	15	37	3.6	12	39	2.0	19	61	28.8
W	3.7	9.0	50	1.9	58	51	3.0	4	27	3.6	10	39	1.5	24	83	27.0
L	3.5	7.3	51	2.0	7.9	49	2.0	44	40	3.1	23	45	1.7	23	74	28.2
W	5.1	9.4	56	2.4	11.9	60	No	No	No	4.4	22	32	1.9	40	65	27.5
L	4.3	10.1	63	2.0	10.7	64	No	No	No	4.2	27	33	1.7	56	71	25.9
W	5.0	5.6	56	1.9	10.9	60	No	No	No	4.1	4	34	1.6	32	75	24.0
L	4.9	6.6	58	2.1	8.0	60	2.5	11	32	3.7	13	38	1.7	42	72	No
W	3.4	9.0	51	2.0	9.3	59	2.1	42	38	3.1	23	46	1.8	49	65	27.3
L	4.2	7.4	53	2.0	9.8	61	2.5	16	32	3.6	21	39	1.7	36	69	No
W	6.6	5.1	47	2.0	8.5	62	No	No	No	No	No	No	1.8	32	67	26.6
L	2.7	7.8	51	1.9	7.3	63	1.6	29	50	2.5	20	56	1.8	45	67	26.8
W	6.7	1.0	47	2.3	8.4	50	No	No	No	No	No	No	2.2	4	55	29.9
L	3.1	9.3	50	2.2	9.7	50	1.3	74	60	2.5	22	56	1.9	16	58	29.0
W	4.5	7.2	53	2.1	8.3	50	No	No	No	4.0	6	35	1.8	21	65	27.7
L	4.8	6.1	50	2.0	8.6	55	2.8	15	29	4.1	15	34	1.9	39	63	26.8
W	4.9	6.3	58	2.4	11.6	55	2.4	25	33	3.7	11	38	2.0	28	61	26.5
L	4.5	8.5	54	2.3	10.9	54	2.3	37	35	3.8	24	37	1.8	27	68	28.1
W	6.6	0.3	56	2.6	7.9	56	No	No	No	No	No	No	2.2	27	55	28.9
L	3.8	5.4	53	2.8	8.2	56	1.9	34	42	3.1	21	45	2.3	30	54	30.4
W	3.8	10.7	53	2.3	11.5	56	2.3	12	35	3.3	22	42	1.8	41	67	24.8
L	4.9	8.6	51	2.2	11.6	60	No	No	No	4.4	9	32	1.7	41	71	26.6
W	4.2	6.8	57	1.8	8.1	57	2.5	13	32	3.9	18	36	1.6	57	72	24.0
L	4.9	4.6	53	1.8	7.0	62	No	No	No	4.0	14	35	1.4	55	88	23.6
W	4.5	9.4	51	2.2	7.5	57	No	No	No	4.2	3	33	2.1	28	57	25.0
L	3.4	8.3	52	2.4	6.6	59	2.1	14	38	3.5	10	40	2.4	21	50	25.8
W	4.1	8.7	48	2.1	9.2	54	2.5	11	32	3.8	17	37	1.7	24	71	29.1
L	4.6	8.6	49	2.2	10.4	50	2.4	16	33	3.9	18	36	1.9	38	63	29.0

(suggesting chronicity of the disease, possibly generated by compression before infection), 2 because they had had bariatric surgery, 2 because they reported previous trauma to one hand, which resulted in 29 individuals being included in the final sample.

2.2. Clinical and electrophysiological evaluation

During the clinical evaluation of the 29 individuals, the characterization and location of the sensory symptoms in the upper limbs was recorded, as well as the presence of atrophies and the time of onset of symptoms in relation to the infectious condition.

The electrophysiological study was performed with 29 patients with electromyography using the recommended technique [7,8], after heating limbs above 33C. The median and ulnar motor nerves, and the median sensory nerves were studied in the palm-wrist and II finger-wrist segments, and ulnar nerves. F-waves were obtained in the ulnar nerves. The concentric needle electrodes for electromyography were placed on the radial flexor of the carpus, the triceps brachii, the extensor carpi radialis, the extensor digitorum communis and the abductor pollicis brevis.

The electrophysiological diagnosis and severity of CTS was established according to the following criteria: grade 0 or normal: normal sensory and motor conduction; grade 1, very mild: only the most sensitive tests are affected; grade 2 or mild: reduced sensory conduction velocity (SCV) in the finger II-wrist segment; grade 3 or moderate: median nerve motor latency altered, but < 6.5 ms; grade 4 or severe: absence of sensory nerve action potential (SNAP) and median nerve motor latency altered < 6.5 ms; grade 5 or very severe: absent SNAP and median nerve motor latency > 6.5 ms; grade 6 or extremely severe: absence of median nerve motor potential or amplitude < 0.2 mV (7) (Table 1).

L: left; W: right; M: motor; S: sensitive; F: wave F; Lat.: latency; Amp.: amplitude; Vel.: velocity; No: not obtained.

3. Results

Twenty-nine individuals underwent clinical and neurophysiological evaluation. Only 4 were male (13%). All presented numbness in hands as the main symptom, which started after having the clinical picture of

an arboviral infection. Twenty-seven individuals attributed the condition to chikungunya.

Of the 29 individuals, 77% identified the II or III fingers as the most affected, and 73% reported pain, more intense in the night. In addition, symptoms manifested bilaterally in 86% of individuals and, in these cases, were asymmetrical in 74%. Symptoms started < 14 days after infection, during the acute phase, in 15% of the individuals. In 62%, they started within 60 days of the beginning of the infectious stage. The remaining individuals were not able to report precisely when the onset of symptoms occurred. None of them reported the beginning of symptomatology > 90 days after the acute phase.

Ninety-two percent of individuals reported edema in the joints of the hands; 82% reported worsening of symptoms at night; 38% changes in motor ability or loss of strength in the hands; 20% reported paresthesia in at least one lower limb.

Electrophysiological study: Twenty-nine individuals were evaluated in two limbs, giving a total of 58 median nerves, of which 54 showed changes compatible with CTS. Median nerve compression in the carpal tunnel occurred unilaterally in only 4 individuals (13.7%). CTS was classified as mild in 14 median nerves (24.1%), moderate in 19 (32.7%), severe in 14 (24.1%), very severe in 4 (6.8%) and extremely severe in 3 (5.1%).

In 10 individuals (34%) the CTS was symmetrical, that is, it had the same classification of severity in the median nerves. In 3 subjects, changes in the sensory conduction of the ulnar nerve was observed. No subjects demonstrated nerve conduction blockages at the elbow or electrophysiological signs of proximal neuropathies.

4. Discussion

During the arbovirus outbreak in north-eastern Brazil, some patients were observed to have persistent acroparesthesia after the acute phase of the infection. Due to a clinical picture of intense persistent joint involvement, these cases were recognized by the individuals, and by the doctors who treated them as chikungunya, although no serological tests were performed on the patients. In this paper, the authors describe the clinical and electrophysiological findings of a series of cases of patients who presented with acroparesthesia after having a clinical picture suggestive of an arbovirus. There is no way to confirm that all cases were caused by the chikungunya virus, due to the unavailability of serological tests at that time in this region.

The cases reported here clearly demonstrate that the symptoms of acroparesthesia started after the infectious condition in an early stage of the disease. The clinical features of acroparesthesia are quite similar to the clinical picture of median nerve compression in idiopathic carpal tunnel syndrome. In the study, women had a higher prevalence of the condition, and electrophysiological findings were similar to those already described for idiopathic CTS [6,8,9].

This is the first time that CTS has been confirmed as a neurological manifestation of arboviruses, through clinical signs and electrophysiological studies in individuals with evident exposure to the virus during an endemic outbreak in the State of Sergipe. Javelle et al. [5] reported cases of patients which developed with typical symptoms of CTS in the chronic phase of the disease. Other reports of infection of the peripheral nervous system were of the involvement of the optic nerve and facial paresis [2–4]. In our opinion, the relationship of CTS with arbovirus infection is due to a complication of joint inflammation rather than direct damage caused by the virus. Situations in which there is increased content within the carpal tunnel have been described in the literature as the cause of CTS [1]. In the case of chikungunya, the reports of joint pain are usually seen with presence of edema in the joints, mainly of the hands and ankles [5,6]. Case studies of chikungunya by ultrasonography of the wrists and ankles have shown signs of joint inflammation, with a high prevalence of tendonitis, joint effusion, myositis and bursitis [6]. Mogani et al. [6] demonstrated in a series of case reports that 69% of the individuals who had chikungunya presented joint effusion, and 59% developed tenosynovitis in the ankles.

Although CTS does not have the same potential severity as other arboviral neurological manifestations, the symptoms of pain and numbness in the hands have been a major complaint of chikungunya patients, and were present in all the subjects evaluated in this study. In addition, in some of our cases, as observed in the electrophysiological test results, compression was severe and there was a great risk of irreversible axonal degeneration. In more severe cases, surgical intervention should be performed promptly to reduce symptoms and prevent extensive axonal loss in the median nerve fibers.

Conflict of interests

The authors declare that there is no conflict of interests regarding the publication of this paper. Work did not receive financial assistance.

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