ORIGINAL RESEARCH

Impact of chikungunya virus infection on oral health status: An observational study

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ABSTRACT

Background and Objective: Chikungunya fever outbreak started in December 2005 in India when the country experienced more than 13 lakhs of Chikungunya infected cases. We undertook this study to describe the impact of Chikungunya virus infection on oral health.
Materials and Methods: The confirmed seropositive patients were included for the study (N = 97). Oral hygiene index simplified, gingival index, plaque index were recorded.
Results: Of the 181 tested, 97 were confirmed seropositive for chikungunya infection. Pain and bleeding gums were seen in 55% of the subjects. Of them, 29.1% had poor oral hygiene, 42.27% had severe gingivitis, and 27.84% had severe plaque deposits. Severe gingivitis was observed in patients with chronic disease, this association was statistically significant ($\chi^2 = 6.417$, $P = 0.040$).
Conclusion: Our findings showed that about more than half of the tested patients suffered severe pain and bleeding in the oral cavity thereby causing discomfort in chewing. About 1/3 patients had severe gingivitis and foul breath which caused discomfort in carrying out their day-to-day activities.

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Chikungunya fever is a mosquito borne illness of humans caused by Chikungunya virus (CHIKV).[1] This disease was first described in 1955, following an outbreak on the Makonde plateau along the border of Tanganyika and Mozambique.[2] Chikungunya virus is no stranger to the Indian subcontinent. Since its first isolation in Kolkata[3] in 1963, there had been reports from different parts of India viz, Vellore,[4] Chennai,[5] Nagpur,[6] Barsi.[7]

Since the last outbreak of chikungunya fever there had been very few reports of chikungunya virus infection in our country. However, since December 2005, cases of chikungunya were reported from several Indian states including Andhra Pradesh, Maharashtra, Karnataka, Tamil Nadu, and Madhya Pradesh[8] suggestive of re-emergence of the virus.

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Although there is abundance of literature explaining the detailed clinical profile and manifestations of chikungunya fever, few studies have addressed the oral health-related symptoms among patients suffering from chikungunya viral infection. Hence, this descriptive study was carried out to describe the oral health related symptoms among patients suffering from chikungunya virus infection.

MATERIALS AND METHODS

In this descriptive study, a total of 208 suspected cases of chikungunya fever during the epidemic period of June to Sep 2006 were enrolled consecutively. These patients visited a private outpatient clinic at Bijapur, Karnataka, India. Of the 208 cases, 27 were excluded as they suffered from concomitant systemic diseases or were on medication, which could affect the gingival health.

Blood samples were collected from each patient with their prior written informed consent for further studies. From all the patients, 5 ml of venous blood was collected in heparinized tubes and centrifuged at 1500× *g* for 15 min at 4°C. Plasma and pelleted RBC were separated and analysis was done immediately by using SD BIOLINE Chikungunya IgM Test Kit, a solid phase immunochromatographic assay for rapid, qualitative detection of IgM antibodies to chikungunya virus in human serum or plasma. Of

the 181 cases tested, 97 were confirmed seropositive for chikungunya infection. Only the seropositive cases were further evaluated. Detailed history of the pertinent information like name, age, sex, location of residence, date of onset of illness, medical history was taken and clinical examination of the oral cavity was performed. Details of the measures taken by the patients for oral hygiene maintenance were recorded. Oral Hygiene Index Simplified (Green and Vermillion1964),[9] Gingival index (Loe and Silness1963),[10] Plaque index (Silness and Loe 1964)[11] were recorded among all the patients. Examination and recording of indices was performed by a single calibrated examiner (k ≥ 0.05). The findings were then subjected to statistical analysis using Chi square test and correlation coefficient.

RESULTS

There were 97 confirmed cases of chikungunya viral fever (n = 97). The mean age ±SD was 36.27 ± 11.36 years, age range 17–58 years, 53.35% of them were in the age range of 20–40 years. Female to male ratio was 1:0.9 (50 females and 47 males).

Pain (54.32%), bleeding, and burning sensation in the gums (54.32%), were predominant complaints, followed by inability to chew and swallow (29.1%), halitosis (21.34%), ulceration (17.46%) [Table 1].

Pain was seen almost equally amongst younger (64.1%) and older age (67.85%) group individuals. Burning sensation in the gums was more common among younger age (71.79%) group whereas symptoms like bleeding gums (96.42%), inability to chew (39.28%), and halitosis (28.57%) were more pronounced in older age group subjects [Table 2].

Oral hygiene status among 70.1% of the patients was fair and 29.9% was poor. Gingival index revealed that 5.15% had mild, 52.58% had moderate, and 42.27% had severe gingivitis (r = 0.486, $P \leq 0.001$). Among 19.58% of the patients, severe gingivitis was observed in spite of the low calculus scores (r = 0.207, $P \leq 0.001$). Some 72.16% of the subjects had moderate amount of plaque, while only 27.84% had severe plaque deposits (r = 0.589, $P \leq 0.001$).

Patients were compared for the oral hygiene status, gingival status, and plaque accumulation during different stages of the disease[12] [Table 3]. Statistically significant association was found in gingival index scores ($\chi^2 = 6.417$, $P = 0.040$). Severe gingivitis was observed in patients suffering from chronic disease while among patients with acute disease moderate gingivitis was observed. No significant association was seen with respect to oral hygiene status ($\chi^2 = 2.116$, $P = 0.347$) and plaque scores ($\chi^2 = 4.125$, $P = 0.127$).

Patients were compared for the severity of pain during the various stages of the disease [Table 4]. Pain in gums was

Table 1: Clinical findings of patients with chikungunya

Symptoms	Number of patients (%)
Pain in gums	56 (54.32)
Burning sensation	56 (54.32)
Bleeding in gums	56 (54.32)
Inability to chew and swallow	32 (29.1)
Halitosis	22 (21.34)
Ulceration	18 (17.46)
Inability/pain in opening mouth	12 (11.64)
Excessive salivation	10 (9.7)
Distaste	10 (9.7)
Whitish discharge from gums	8 (7.76)
Loosening of teeth	1 (0.97)

Table 2: Comparisons of symptoms observed among different age group in chikungunya patients

Symptoms	Age groups			Chi-squre test
	15-30 yrs (*n* = 39) (23F,16M) (%)	31-45 yrs (*n* = 30) (13F,15M) (%)	> 45 yrs (*n* = 28) (14F,16M) (%)	
Pain in gums	25 (64.1)	12 (40)	19 (67.85)	$\chi^2 = 5.69$ $P = 0.058$ (NS)
Burning sensation in the mouth	28 (71.79)	16 (53.33)	12(42.85)	$\chi^2 = 5.937$ $P = 0.051$ (S)
Bleeding in gums	11 (28.21)	18 (60)	27 (96.42)	$\chi^2 = 31.179$ $P = 0.000$ (S)
Inability to chew and swallow	08 (20.5)	8 (3.75)	11 (39.28)	$\chi^2 = 3.759$ $P = 0.153$ (NS)
Halitosis	8 (20.5)	6 (20)	8 (28.57)	$\chi^2 = 0.782$ $P = 0.677$ (NS)
Ulceration	7 (17.95)	6 (20)	5 (17.86)	$\chi^2 = 0.060$ $P = 0.97$ (NS)
Difficulty/pain in opening mouth	4 (10.26)	3 (10)	5 (17.86)	$\chi^2 = 1.094$ $P = 0.579$ (NS)
Excessive salivation	2 (5.1)	5 (16.66)	3 (10.71)	$\chi^2 = 3.759$ $P = 0.153$ (NS)
Distaste	4 (10.26)	5 (16.66)	1 (3.6)	
Whitish discharge from gums	0	6 (20)	4 (14.28)	
Loosening of teeth	0	0	1 (3.57)	

Table 3: Comparison of oral hygiene status, gingival health and plaque accumulation among chikungunya patients

Symptoms	Classification of cases			Statistics
	Acute *n* = 51, (<7 days) (%)	Subacute *n* = 29, (7-14 days) (%)	Chronic *n* = 17 (>14 days) (%)	
Oral hygiene status				
Good	00	00	00	$\chi^2 = 2.116$
Fair	39, (66.66)	18, (62.06)	11, (64.70)	$P = 0.347$ (NS)
Poor	12, (31.37)	11, (24.13)	6, (35.29)	No association
Gingival index				
Mild	2, (25.5)	3, (10.34)	0	$\chi^2 = 6.417$
Moderate	33 (64.70)	12 (41.38)	6 (35.29)	$P = 0.040$ (S)
Severe	16 (3.27)	14 (48.27)	11 (64.7)	Association found
Mild	00	00	00	$\chi^2 = 4.125$
Moderate	40 (86.27)	21 (72.41)	9 (52.94)	$P = 0.127$ (NS)
Severe	11 (21.57)	8 (27.59)	8 (47.06)	No association

Table 4: Comparison of pain among patients with varying severity of pain

Symptoms	Classification of cases			Statistics
	Acute *n* = 51, (<7 days)	Subacute *n* = 29, (7-14 days)	Chronic *n* = 17 (>14 days)	
Pain in gums				
Mild pain	5, 9.8	3, 10.3	6, 35.29	Pooled
Moderate pain	9, 17.64	7, 24.13	5, 29.41	$\chi^2 = 0.962$
Severe pain	11, 21.56	4, 13.79	6, 35.29	$P = 0.618$ (NS)
				No association
Pain while chewing				
Mild pain	3, 5.88	1, 3.45	0	Pooled
Moderate pain	5, 9.80	4, 13.79	1, 5.88	$\chi^2 = 2.353$
Severe pain	13, 25.49	2, 6.89	1, 5.88	$P = 0.5$ (NS)
				No association

observed more commonly among the patients suffering from chronic disease, whereas pain while chewing was seen frequently in patients with acute disease. However, no statistically significant association was observed.

DISCUSSION

The present study was carried out among the confirmed cases of chikungunya virus infection. Many studies have focused on the classical symptomatology of chikungunya virus infection like a clinical triad of 'fever, rashes, and arthralgia',[2,4-7,13-26] but few studies mention the effects of chikungunya virus infection on oral health.

There were about 53.53% of the patients in the age range of 20–40 years. Some authors have reported prevalence in age group between ≥15 and ≤30 years,[8,14] while another reports majority of patients above age range >45 years.[15] The variation may be attributed to the differences in the herd immunity.[8,13,14]

We observed that females were slightly more affected as compared to males with the ratio of 1:0.9. Similar findings are reported in literature.[8,16-18] In contradiction to the present findings, some authors have found female to male ratio as 1:2.3[14] and 1:2.4.[15]

About 95% of the individuals suffered from mild and severe gingivitis, while 31% was reported by some.[14] Other studies have also reported cases of gingivitis in their study.[7] Since no index was used by these authors to measure gingivitis, it is likely that only the severe cases of gingivitis were recorded and severity of the disease was not emphasized. The underlying pathology in causation of gingivitis remains unclear. Perhaps the leucopenia[15] caused by the disease may be playing a role in this.

The study reporting the effect of chikungunya virus infection on connective tissue[19] states that there is an increased excretion of urinary proline and hydroxyproline in these cases, which is suggestive of high degree of turnover in connective tissue. Whether this affects the integrity of gingival tissue and the alveolar bone is not confirmed, and this may be causing the alterations in gingival and periodontal health. Further studies with radiographic examination may help to determine the effects on alveolar bone and the periodontal complex.

In the present study, about 55% of the subjects experienced bleeding from the gums. Similar reports are made by other authors.[3,7,14-15,20,21] Mild thrombocytopenia observed[15] in the disease may be causing these episodes of bleeding.

Oral ulceration was observed in about 12% of individuals in this study. In other reports, 9%[14] and 2%[15] of the subjects were affected.

We observed Tempero Mandibular Joint pain in only 6% of the patients. Severe pain involving the other synovial joints has been reported by other authors.[2,4-7,14-17,19-26]

Though majority of the patients performed oral hygiene methods it was observed that oral hygiene among 70.9% of the patients was fair and 29.1% was poor. This may be because severe pain in the gums might have prevented the patients from performing meticulous brushing. No similar data is available for comparison of the same.

When the patients were compared for the oral hygiene status, gingival status and plaque accumulation during different stages of the disease, severe gingivitis was seen among patients with chronic disease, while mild to moderate gingivitis among patients with acute stage. The difference may probably be attributed to inability to clean the oral cavity properly for longer duration in chronic patients which is reflected in the higher plaque scores in these patients. This accumulated plaque might have caused the subsequent gingivitis.

Studies[14] have reported that following up of patients for a period of 90 days has shown that in half the proportion of patients suffering in the form of arthritis persisted. In another report[20] the symptoms persisted in 10% of the patients even after 3–5 yrs. Hence, a follow-up of patients to observe for resolution of oral symptoms must be taken into account in future studies. There are reports of functional and ambulatory limitations.[26] In this study, patients expressed their inability to chew varieties of food and so they had to limit their diet to soft, semisolid and liquids in severe cases.

Another area where attention is needed is the technique used by us for the confirmation of the disease. The sensitivity and specificity of the test kits varies based on many factors and manufacturers. Sensitivity varies from 22% to 83%. We used the kit from Standard Diagnostics, INC Korea, which has relative sensitivity of 97.1% and specificity of 98.9%; however; sensitivity of IgM (20%) detection was significantly lower for patients with acute infections (i.e., from day 1 to day 5 after infection) and Cross-reaction with other flavirus antibodies such as o'nyong nyong and Semliki Forest occur in the ELISA; but the latter viruses are relatively rare in South East Asia.[27] The gold standard for the diagnosis of chikungunya fever is viral culture,[28] but this is not routinely carried out because of lack of facilities in majority of centres. Recently, a reverse transcriptase, RT-PCR technique for diagnosing chikungunya virus has been developed using nested primer pairs amplifying specific components of three structural gene regions, Capsid (C), Envelope E-2, and part of Envelope E1.[27,29] For sensitivity determination of the PCR protocols, the probe-based real time RT-PCR method was found to be 10 times more sensitive than one based on SYBR Green.[30] The practically feasible confirmatory test RT-PCR[20] method was not adopted because of inability to get the samples processed at NIV Pune, which is the only national referral centre in India for the chikungunya virus.

The patients included in this study represent a very small sample of the population that was affected by chikungunya during the outbreak. Though there are limitations of this study like a smaller sample size, absence of control group and convenient sampling technique, nevertheless it attempts to give an insight to understanding pain of the patients infected with chikungunya virus. This calls for further analytical studies with appropriate sample size.

CONCLUSION

Several lessons can be drawn from the outbreaks of chikungunya infection in India. Patients may present with variety of symptoms and variable degree of severity. Oral symptoms are far distressing and severe to the patients than previously reported. The compartmentalization involved in viewing the mouth separately from the rest of the body must cease because oral health affects general health by causing considerable pain and suffering and by changing what people eat, their speech and their quality of life and well-being. Although it is a self limiting disease, palliative measures to ease the patient in distress due to oral pain should be employed.

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