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Spreading Oro-fascial Infections: Is the Trend in Burden Changing?

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Abstract

Spreading orofacial infections are often encountered and managed by oral and maxillofacial surgeons. Several factors have been attributed to this spread. It has been reported to be the leading cause of death in maxillofacial patients seen in most hospitals, especially in a resource constraint country like Nigeria. The current study aims to assess factors that contribute to the disease burden of patients with orofacial infection. The case files of 101 patients who were diagnosed clinically of spreading orofacial infections with radiographic confirmation of involved tooth/teeth managed at the LASUTH and OAUTHC Ile Ife over twelve months. The following information was obtained in a prospective study using a proforma; patients' demographics, underlying morbidity, teeth involved, site location, fascial spaces involved, treatment, and outcome. Patients with incomplete data were excluded. All patients had adequate rehydration followed by incision and drainage or decompression as the case required before administration of empirical antibiotics via the intravenous route. Data were analyzed using IBM SPSS version 21.0.

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One hundred and one cases were retrieved for the study. There was an almost equal gender distribution of males 51 (50.05%) and females 50 (49.50%). The female to male ratio of 1.02:1.00. The age range was 12-82 years, the mean age for females and males was (17.6 ± 0.448). The majority of the cases were in the 21-40 age group. A significant percentage (95.0%) of the patients were managed as in-patients. The majority of the death 8 out of 12 were recorded among the age group 51-82 years. Mandibular teeth were more affected compared to the maxillary teeth. Though not statistically significant (p=0.054). The lower right first and second molar (17.82%) each were mostly implicated in the mandible while the maxillary upper right second molar tooth (one-third of the total number of maxillary teeth affected) was the most implicated tooth in the maxilla. Twenty-five of the patients had underlying medical conditions with diabetes mellitus being the commonest (66.7%) among the patients under review. Majority of the patients presented with multiple facial spaces involvement with Ludwig's angina being the commonest presentation. The submandibular space was the most involved space both in single and multiple spaces involvement. The mortality recorded were in patients with Ludwig's angina, temporal and parapharyngeal space involvement. Seven (58.33%) out of the recorded death had involvement of more than four fascial spaces. The commonest treatment offered was incision and drainage with the extraction of the offending tooth/teeth. There was a positive correlation between the length of hospital stay and the duration of drain in-situ.

Fascial space infections in a resource- and personnel-scarce setting still confers a great burden on management. The need for quick surgical intervention, aggressive and adequate antibiotics administrations, high protein nutritional support, and co-managing of patients with other medical teams in controlling associated morbidities are very essential to a good outcome.

Keywords: Spreading; orofacial infection; disease; the burden.

1. Introduction

The oral and maxillofacial surgeons are usually called in for emergency intervention of spreading fascial space infections. These infections do cause severe pain, discomfort, reduced productivity for the patients, and could be a burden on clinic schedules and emergency room (ER)[1]. Advanced age, self-medication, and delayed presentation are some of the factors associated with the spreading of orofacial infection that portends increase morbidity and mortality[2]. Omeje and his colleagues [3,4] reported orofacial infection as the leading cause of death in maxillofacial patients presenting in a tertiary hospital in Nigeria. The present economic depression and limited resources present challenges to the maintenance of quality health care [1]. Only a few primary health care departments have access to technical equipment essential for examining the effect of fascial spaces [1,5]. Thus, a public health burden.

Several factors have been identified in the literature as influencing the diseased burden, late presentation for treatment, self-medication, advance in age, and unusual causative agent have been reported as important issues in a local study[2]. Weise and his colleagues [6] noted inadequate dental treatment as one of the challenges in infection management and that the presence of a medical condition could also worsen the infection. Diabetes mellitus has been reported to be the most common medical disease [7,8], associated with odontogenic infection

in several studies[9,10]. However, the following is also true. Delay in surgical intervention, multiple fascial space involvement, prolonged hospital stays, high-risk infection, airway compromise, high admission White Blood Count (WBC) and advanced age are some of the problems highlighted that posed a challenge to good infection outcome. These factors have a significant association with the high financial burden on the patients[1, 11]. This is made worse in our environment as delay in presentation is often associated with the inability to finance the cost of care[12]. The National Health Insurance Scheme though available is poorly implemented and may be difficult to access where available, thus a large number of patients pay out of pocket [12].

The study aims to assess factors that contribute to the disease burden of patients with orofacial infection.

2. Methods

2.1 Study design

A total of 101 patients diagnosed clinically and radiographically confirmed as fascial space infections were recruited into the study. A structured open-ended proforma was used to collect relevant information from the study individuals. The patients were assessed for the involvement of fascial spaces, duration of spread, and the definitive management instituted. Information such as teeth involved, side location of teeth and abscess, drain placement, duration of hospital stay, and the outcome of treatment was also included in the study. Informed consent was taken for every individual involved in the study

2.2 Study location

This prospective questionnaire-based study was carried out using two centers (Lagos state university teaching hospitals and Obafemi Awolowo University Teaching Hospitals) over twelve months both in the southwest region of the country. Patients were recruited via the Oral and maxillofacial surgery clinics and Accident and emergency unit of the Hospital using structured designed proforma

Patients having secondarily infected tumors were excluded from the study. Incisions and drainage were undertaken for patients immediately after adequate rehydration using intravenous 0.9% normal saline alternate with 4.5% dextrose saline, administration of an intravenous analgesic, and the administration of at least one dose of empirical intravenous antibiotics.

2.3 Data Analysis

Data were analyzed using IBM-SPSS statistics for windows, Version21.0. M Corp. Descriptive statistics were used to characterize demographic variables such as age and sex, for descriptive continuous variables, the mean, median, minimum and maximum values were determined. The mean and standard deviation of categorical variables was done, the correlation between variables was tested with chi-square. In other to predict factors that could result in mortality, logistic regression was created having a dependent variable (mortality) and independent variables (age, number of spaces, presence of comorbidity, and length of hospital stay) with a p-value set at <0.05

3. Results

A total of one hundred and one patients were recruited for the study. Figure 1 shows near-equal gender distribution. Female was 51 (50.5%) and male 50 (49.5%) with F: M ratio of 1.02: 1. The mean age/ standard deviation (17.6 ± 0.448).

Table 1 shows 89.10% of spreading orofacial infections originate from the mandible with a p-value of 0.054. The lower right first and second molar (17.82%) each and lower left second molar (14.85%) were mostly implicated. A significant number of spreading odontogenic infections was seen in the 21-40 age group.

Table 2: two spaces were involved under low-risk score (Buccal 33 (12.84%) & canine 2 (0.78%). Submandibular space was the most implicated 78(30.35%) under moderate risk followed by Submental and submasseteric spaces with 42 (16.34%) and 41 (15.95%) respectively. Three spaces were involved in the study for high severity score (lateral pharyngeal 11(4.28%), anterior neck 2(0.78%), orbital 1(0.39%). The only anterior chest wall was implicated in the extreme risk group 1(0.39%).

Figure 2: shows the underlying medical condition in 25 (24.8%) out of 101 patients seen within the period under review. Diabetes mellitus was the commonest, occurring in more than two-thirds (66.7%) of the medical condition recorded with mortality occurring in 1 out of two patients with the disease.

Table 3 shows demographic distribution (age and gender) and mortality, eight of the 12 deaths recorded were seen within the 51-82 years age range with more females being affected.

In table 4, the number of fascial spaces involves and mortality was presented. The percentage of mortality increases as the number of spaces involved increases with one of two patients with 6 fascial spaces involve having a poor outcome (death).

In Table5, logistic regression was created having a dependent variable (outcome) and independent variables (age, number of spaces, presence of comorbidity, and length of hospital stay). The p-value was set at <0.05

The logistic regression model predicted 96.0% of the outcome variable, mortality. The presence of comorbidity increased the likelihood of death in patients with odontogenic infections by 32.7 times (P=0.005). A shorter hospital stay was found to be significantly associated with mortality with a 0.7-fold increase in the risk of death from spreading odontogenic infection. This was also significant.

Figure 3: shows the surgical intervention given to patients with spreading orofacial space infection. Incision and drainage with tooth removal (91.1%) were the most common treatment offered while the least was extraction (1.0%) only. But a clear strong correlation between the length of stay and the duration of the drain placed (P-value<0.01). The majority of the patients (95.0%) were managed as in-patients while five (5.0%) were managed as outpatients.

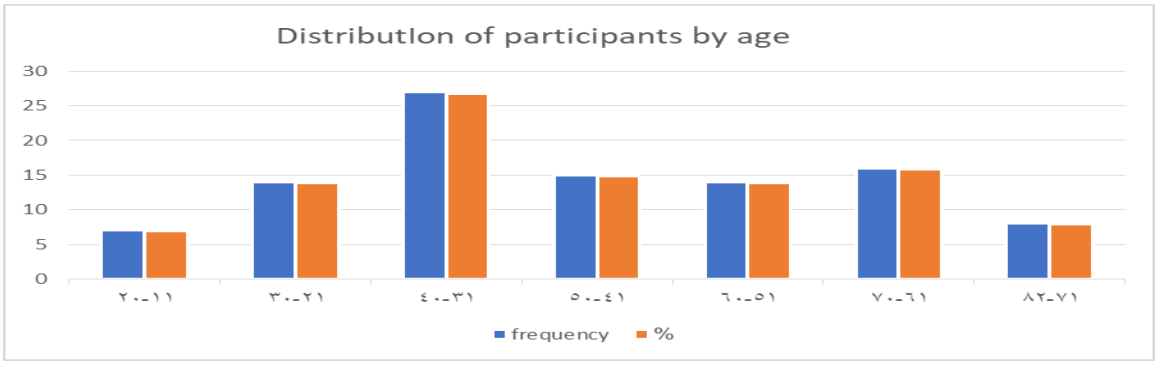

Figure 1

The age range of subjects is 12 to 82, the mean age is 45.17 ±17.69 female to male is 1.02:1

Table 1: Implicated teeth and involvement of jaw bone narratives.

Location		Tooth involved					Total
Mandible	Tooth number	44	45	46	47	48	
		-	-	**23**	**24**	**7**	**54**
	Tooth number	34	35	36	37	38	
		-	**1**	**20**	**19**	**15**	**55**
Maxilla	Tooth number	14	15	16	17	18	
		-	-	**3**	**3**	**1**	**7**
	Tooth number	24	25	26	27	28	
		1	**1**	**2**	**3**	**1**	**8**
					Total		**124**
location	Freq (%) no of patients			**P value**			
Mandible	90 (89.10%)			**0.054**			
maxilla	9 (8.91%)						
both	2 (1.98%)						

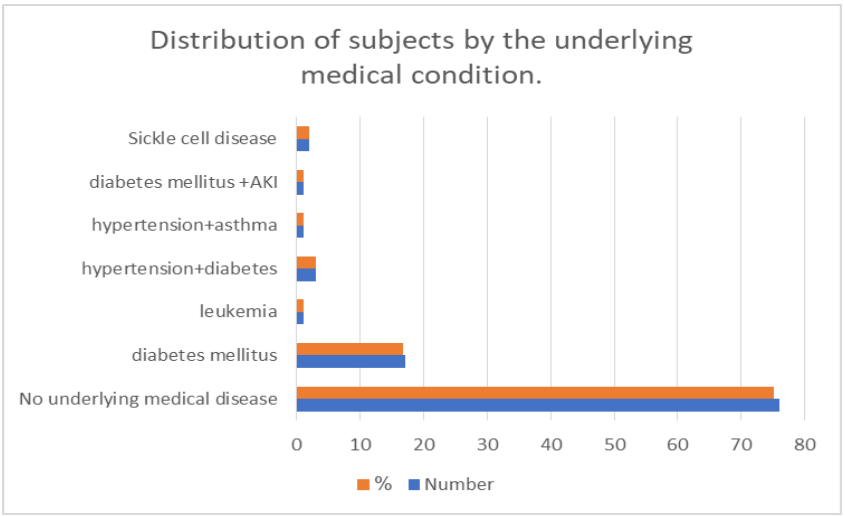

Figure 2: Medical comorbidities in patients with spreading odontogenic infections**.**

Table 2: Distributions of fascial space involvement based on Severity score of fascial space infections.

Severity score	Risk	Space involved	Freq (%)
1	Low risk	buccal	33 (12.84)
		canine	2 (0.78)
2	Moderate risk	Submandibular	78 (30.35)
		Submental	42 (16.34)
		Sublingual	36 (14.01)
		Submasseteric	41 (15.95)
		Superficial temporal	1 (0.39)
		Deep temporal	8 (3.11)
		Supraclavicular	1 (0.39)
3	High risk	Lateral pharyngeal	11 (4.28)
		Anterior neck	2 (0.78)
		orbital	1 (0.39)
4	Extreme risk	Anterior chest wall	1 (0.39)
		Total	257

R. Mirochnik *and his colleagues* [13]

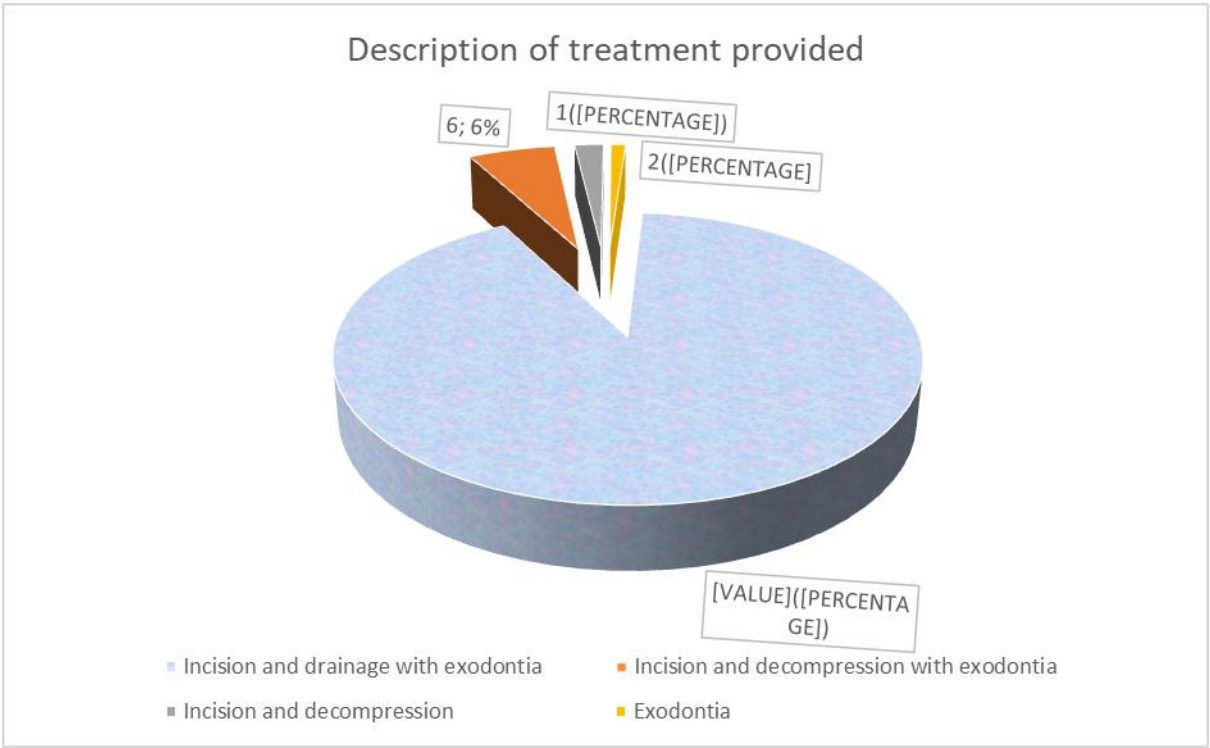

Figure 3

Table 3: Distributions of Age and gender concerning Mortality.

Age range	male	female	Mortality
12-20	2	5	0
21-30	10	4	1
31-40	14	13	2
41-50	7	8	1
51-60	6	8	1
61-70	7	9	2
71-82	4	4	5

Table 4: Mortality distributions in Association with number of fascial spaces involvement.

Fascial spaces	**mortality**		**total**
	Alive	**Death**	
1	8	0 (0.0%)	8
2	26	3 (7.8%)	29
3	24	2 (8.33%)	26
4	12	2 (16.67)	14
5	18	4 (22.2%)	22
6	1	1 (50.0%)	2
Total	**89**	**12**	**101**

The involvement of 4 or more spaces was found to be associated with high mortality. Seven of the 12 reported death was found to be involved in more than four fascial spaces.

Table 5: Predictors of mortality in patients with spreading.

Independent variables	Dependent variable: Mortality (Alive, Death)			
	B	OR	95% CI	p-value
Age	0.040	1.041	0.93-1.10	0.168
Number of fascial space involved	0.30	1.347	0.59- 3.08	0.479
Length of hospital stay	-0.400	0.670	0.50-0.90	0.007*
Presence of comorbidity	3.47	32.7	2.86-373,2	0.005*

5. Discussions

Odontogenic infections can be prevented, but they remain a considerable burden on the healthcare system[6, 14, 15]. The patterns and occurrence of fascial infections have been well reported, however, despite the use of antibiotics global epidemiological surveys have revealed that some aspects of the trends of fascial infections remain unchanged among the various nations [2]. A large number of the treated cases in this study were managed as inpatients. The presence of painful facial swelling, fever, trismus dehydration, and impeding air obstruction were the features identified necessitating hospital admission. These features are factors that determined the setting of care in patients with spreading odontogenic infection.[16] The cellulitis stages are the most dreadful stage in spreading fascial space infection[16]. The rapidly advancing inflammatory exudate can be quite devastating with dyspnea and dysphagia. This stage is usually seen within 3-5 days after the onset of infection. The mean time of presentation in the study was 4.74 days which is comparable to other studies [10, 15, 17] and lower than the figure stated by fomete and his colleagues [8] who reported a mean time of presentation of 11.0±9.4 days. The option for early intervention in preventing the spread of infection can no longer be instituted due to delayed presentation of patients, this possibly contributed to spreading of the infection in the patients and the longer hospital stay in the study [17,18] Orofacial infections mostly occur during the age of 21–40; besides, the prevalence of the disease is not gender-related [19, 20,21,22]. This is in tandem with the finding in this study. Several studies show males to be more predisposed to oro-fascial space infections[21,23], this may be a result of more males being involved in social activities which are said to prevent them from paying attention to their oral hygiene and also practicing more detrimental oral habits like smoking[2]. Akinbami[2,24] and Suehara and his colleagues [25] believed that the females pay more attention in caring for their health especially parts noted to add beauty to their nature this peradventure influences their number involved with fascial space infections [2,25]. Other factors that may have contributed to infection in these age range are subjection of the occlusal surface to heavy masticatory stress, higher susceptibility to caries, tendency to have stagnation of food debris on occlusal fissures, and reduced accessibility to thorough hygiene. [2] The permanent molars were most involved especially the lower left first and third molars. Molars are well adapted for occlusal grinding and chewing the presence of deep grooves and fissures encourage stagnation of food debris. The involved molars in our study are not surprising and this is no different from the findings in some studies conducted within and outside of Africa [2,10,26]. Higher susceptibility to caries by the molars, and reduced accessibility to thorough hygiene which can give rise to orofacial space infections [2] Extremes of age is an established factor in the spread of orofacial infection [21,25]. Akinbami and his colleagues [2] found spreading odontogenic infection more in patients in their sixth decade of life. Although mortality as a result of spreading orofacial infection occurs more in the elderly, infections occurred mostly between the 2nd and 3rd decade in patients in this study. There seems to be a change in the trend, this can be attributed to the use of substance abuse, dental health neglect, self-medications, failure of initial treatment, and over-dependence on antibiotics as the primary mode of treatment [17,18,20,27,28]. Diabetics Mellitus disease ranked highest among the systemic comorbidity presented in this study. This is similar to several studies and it is reported to have the highest mortality rate (66.7%) of all the underlying medical conditions [8,25,29]. In diabetic patients, there is suppression of the host's immune system due to the impairment of the leucocyte functions by the high glucose level in circulation [25]. The individuals become more susceptible and when not properly controlled can result

in the fatal outcome as observed in this study [28] The literature describes that most fascial spaces are affected by odontogenic infection in the same proportion as determined by their proximity to the roots of teeth [30,31] The submandibular space is considered to be important in odontogenic infection because infection in this space is often accompanied by changes in other surgical spaces[31]. In this way infections that are originated in lower molars mainly affect submandibular, sublingual, and buccal spaces [30,32]. submandibular space is also the most common site involved in multiple space infection, our data are comparable with the studies stating the submandibular space as the most involved either as singly or in multiple space involvement. [1,21,22,33]. Multiple space involvement in the study is found to be associated with an increase in the period of hospital stay and longer use of drains. This may be due to the increased severity of the infection and late presentation.[10] Submasseteric space abscesses were more common than those with submandibular space abscesses in some other studies in southwest Nigeria, however reasons for this were not clearly stated but proximity to the mandible ramus and compactness caused by the masseter muscle was given as likely cause[2,24] The principles of management of spreading orofacial infection are aimed at the removal of the cause of infection, eliminating the accumulation of pus, necrotic tissue, and enhancing the effectiveness of antibiotics via improvement of vascular flow[6,18]. These include incision and drainage, extraction of the associated tooth, antibiotic administration, and giving of supportive care (feeding patients with food rich in protein). Incision and drainage abort the spread of infection into deeper and more critical anatomical spaces even in the cellulitis stage [16]. The treatment protocol in the study centers entails the administration of at least a dose of intravenous antibiotic before any surgical intervention. The choice of anesthesia in the management of infection depends on the presence or absence of airway obstruction and the need for pain control during incision and drainage/decompression. The patients with airway obstruction and need for extensive exploration had their intervention under general anesthesia Patients with impending or no airway embarrassment were treated under local anesthesia Safety, cost-effectiveness, and less technique sensitivity are the reason why local anesthesia favoured[1,11,14]. All except one patient had incision and drainage/decompression. This is also in agreement with other studies[2, 7, 15, 34]. The only patient who had an extraction done presented with a submandibular space infection at the inoculation stage. Facial swelling though present was soft and mildly tender. The extraction socket serves as drainage and antibiotic prescribed aided complete resolution.

Mortality in the maxillofacial unit is low, but when it does occur orofacial Infections have been reported as the most common cause of death. [4]. Twelve (11.9%) mortality were recorded in this study. Umeje and his colleagues [4] reported slightly higher mortality in 26 patients (22.6%) with orofacial infection. Their sample size was slightly higher and the period during which the review was done, was longer compared to our study. The presence of an underlying condition seems to be a risk factor[9,10,35]. The role of co-morbidity in the etiology, progression, and outcome of infection is well known[9,35]. One in every two patients with diabetes succumbs to their infection in our study. Diabetics is the most common immune-compromising disease [6,25,36,37]. Diabetes account for 8 (66.7%) of death recorded in the period under review. This is similar to other studies[38]. The disease inhibits successful chemotaxis of white blood cell to the infection site due to its migratory defect and also impair blood flow as a result of a vascular defect. All patients with co-morbidity were managed by a multidisciplinary team approach in compliance with other studies [38]. The severity of infection, as well as the number of fascial spaces involved, may also be an important factor to note. Twenty-two cases of

Ludwig angina were seen within 12 months. Ugboko and his colleagues [39] and Braimah and his colleagues [40] reported 16 cases in 14 years and 28 cases in three years respectively. There seems to be a steady increase in the prevalence of Ludwig angina[38–40]. We can attribute our experience in this study to the poor economic state of the country preventing them from affording a good and high nutritious diet that builds up better immunity. Late presentation at the treatment centers could also be a factor in facilitating the further progression of the mild disease state to a more severe one[2,39,40]. Four of the twenty-two patients diagnosed with Ludwig expired. Three died as a result of severe sepsis even after the airway was secured surgically, while the last, a diabetic patient died after surgical intervention due to poor compliance with required medications which worsen the patient's clinical status. In a Taiwan study, on mortality from orofacial infections, sepsis was identified as the most common cause of death[38]. The fee-based health system and poor health insurance policy remain a major challenge in the management of patients with life-threatening orofacial infections [4,32]. In a national survey of death from oral and maxillofacial infections, Wong found mortality in patients older than 40-years of age. This is in contrast to our study in which 3 (25%) of the death recorded were less than 40 years of age.

5. Conclusion

The trend in presentation, duration and management seems not to have changed. Improving the health insurance scheme will prevent the burden of the fee-based health system prevalent in the country which contributes to late hospital presentation and burden of the absolute financial responsibility by the patient. There is always the need for vigilance in managing fascial space infection by promptly responding when presented and the need for the use of an appropriate and adequate dose of medications.

6. Limitations

This study involved two centers located in the southwest region of the country, involving other health managing institutions in other parts of the Nation will give more perception to the disease burden.

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8. Conflict of interest

The authors declare no conflict of interest

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