



Research Article

Fascial space infection of Odontogenic Origin: A Review of Cases treated in a Nigerian Teaching Hospital

**Adesina Oluwafemi A¹, Wemambu John C², Opaleye Taofiq O²,
Salami Ajibola Y², Salmon Abeeb O²**

¹Department of Oral & Maxillofacial Surgery, Faculty of Dentistry, Lagos State University College of Medicine, Lagos State, Nigeria. ²Department of Oral & Maxillofacial Surgery, Department of Dentistry, Lagos State University Teaching Hospital, Lagos State, Nigeria.

**Author for Correspondence:*
Adesina O. A.

femmyadesina2000@yahoo.com

Keywords:

Fascial space,
infection,
Odontogenic

ABSTRACT

Objective: Fascia spaces of the head and neck are potential spaces around the mouth and face. The spread of infection to the head and cervical areas are often of odontogenic origin. This study aims to review the cases of fascial space infection of odontogenic origin who reported for treatment at Lagos State University Teaching Hospital.

Methodology: A study was carried out on patients who had been managed for orofacial fascial space infection at the Lagos State University Teaching Hospital from January 2017 to December 2019. All the patients were treated at either the surgical emergency or the Oral and maxillofacial department and admitted in the same hospital. Ethical approval was obtained and data retrieved from the clinical records of the patients and subsequently analysed using SPSS Version 20 Chicago IL USA.

Result: A total of 50 patients with fascial space infection were managed during the study period. The predominant age group was between 31 to 40 years of age accounting for 38.0% of all the cases. Submandibular space (36.0%) infection had the highest frequency. The most common etiological factor was caries related (60%), followed by periodontal infection (20%). Thirty-four patients (68%) were medically fit, sixteen (32%) patients had underlying medical condition among whom 8 (16%) were diabetic.

Conclusion: Fascial space infection was more commonly found in the 4th decade of life with no significant gender predominance. Caries related infection involving the third molar was the major source of spread. The submandibular space was the most frequently affected fascial space.

INTRODUCTION

Fascia spaces of the head and neck are potential spaces around the mouth and face.[1] In health, these spaces do not exist; they are formed when there is pathology. [2] The spread of infection to the head and cervical areas are often of odontogenic origin and to a lesser extent from foreign bodies trauma. [3] Acute cervical space infection occurs in any age group but are more commonly associated with the patients with poor oral hygiene and lack of dental care. [4] The second and third mandibular molars are the teeth that are often implicated in the cause of odontogenic deep neck infections. [5,6]

Odontogenic infections are usually locally confined and self-limiting. However, under certain circumstances, like anatomical variations or suppression of the immune system of some individuals, these infections may pass through the bony, muscular, and mucosal barriers and spread into contiguous and distant spaces, resulting in severe fulminating infections in the body cavities. [7] The patterns of infection may include abscess formation, cellulitis, and necrotizing fasciitis. The mainstay of treatment includes antibiotic therapy and surgical drainage. [4]

However, when these infections occur, they are often difficult to assess accurately by clinical examinations and conventional radiographic techniques, and the outcome may be serious and potentially life threatening. [8] Furthermore, delay or poor management of deep neck infections has been the cause of high mortality. [3] Therefore, it is important to understand the anatomy of the potential spaces, rate of progression and potential for airway compromise of this condition. [9] This study aims to review the cases of orofacial space infection of odontogenic origin who reported for treatment at Lagos state university teaching hospital.

METHODOLOGY

The study was carried out on patients who had been managed for orofacial fascial space infections at the Lagos state university teaching hospital, a major tertiary centre in city of Lagos, Nigeria, from January 2017 to December 2019. All the patients were treated at the Surgical Emergency and Oral and Maxillofacial Departments and admitted in the same hospital. Ethical approval was obtained from the ethical committee of the same hospital and the clinical records of the patients were retrieved.

According to the records the fascia space involvement were classified into the following fascial spaces: canine space, buccal space, submasseteric space, sublingual space, submandibular space, and multiple involvement as in Ludwig's angina when there is bilateral and simultaneous involvement of submandibular, sublingual, and submental spaces, and other secondary spaces (parapharyngeal space, retropharyngeal spaces).

Record of the etiological factors, implicated tooth or teeth, underlying medical conditions, the time lapse before presentation for treatment and the duration of hospital stay were also noted.

Treatment modalities including antibiotic therapy and surgical approaches were also recorded. Detail record of patients with complete resolution and those who came down with complications and record of mortalities were noted.

Data were analysed using the statistical package for the social sciences (SPSS) version 20 for window (SPSS Chicago IL USA) Chi square test was carried out and the level of significance was set as $p < 0.05$.

RESULTS

A total of 50 patients with fascial space infection were managed over the period of the study. Of these, males accounted for 26 (52.0%) and females 24 (48.0%). Age ranged from 12 to 82 years with a mean of 34.01 ± 9.7 years. The predominant age group of 31-40 years accounted for 38.0% of the cases, followed by the 41-50 years age group (24.0%) Table 1.

Submandibular space infection had the highest frequency accounting for 36.0% of the cases. This was followed by Ludwig angina (22.0%) (Figure 2) Table 2.

The most common etiological factor was caries related (60%), followed by periodontal infection (20%). The source of infection with the least frequency was retained root (4%) - Figure 1. In 20 (40%) of patients lower third molars was implicated, followed by lower second molars in 12 (24%) patients. Thirty-four patients (68%) were medically fit, sixteen (32%) patients had underlying medical condition among whom 8 (16%) were diabetic.

Only 22 patients (44.0%) presented in less than 1 week (7 days) of onset of symptoms whereas a large number (56%) were seen after 1 week. Most (60%) of the patients were discharged from admission in less than 1 week - Table 3.

Of the fifty patients, 23 (46%) were treated with our routine intravenous empirical antibiotics (Intravenous ceftriaxone 1g 12 hourly, intravenous metronidazole 500mg 8 hourly and intravenous gentamycin 80mg 8 hourly), with incision and drainage or decompression as the case required, combined with extraction of the offended tooth or teeth, whereas in 34% of cases there was no need for additional incisional and drainage after the tooth/teeth were extracted. However, in 20% of cases more specific antibiotic therapy was instituted following bacteria culture result Table 4.

There was complete resolution in 60.0% of cases. However, 10 patients (20%) developed necrotizing fasciitis despite intervention. We recorded 8 cases (16%) of mortality. Three (6%) of these died after they had developed necrotizing fasciitis (Figure 3) and five (10%) from Ludwig angina Table 5.

Table 1: Distribution by Age and Gender

Age group (Years)	Male (n=26) (%)	Female (n=24) (%)	Total (%)	p-value
1-10	0(0.0)	0(0.0)	0(0.0)	
11-20	1(3.8)	3(12.5)	4(8.0)	0.431
21-30	6(23.1)	2(8.5)	8(16.0)	0.041*
31-40	9(34.6)	10(41.7)	19(38.0)	0.318
41-50	8(30.8)	4(16.7)	12(24.0)	0.575
51-60	0(0.0)	3(12.5)	3(6.0)	0.496
61-70	2(7.7)	1(4.2)	3(6.0)	0.443
Above 70	0(0.0)	1(4.2)	1(2.0)	0.103
Total	26	24	50	0.791
Mean $\pm$ SD	33.41 $\pm$ 10.5	32.89 $\pm$ 9.4	34.01 $\pm$ 9.7	0.719

Table 2: Distribution of Fascial spaces involvement

Anatomical spaces	No. of cases	Frequency (%)
Submandibular	18	36.0
Submental	2	4.0
Sublingual	2	4.0
Submasseteric	10	20.0
Buccal	3	6.0
Ludwig Angina	11	22.0
Canine	2	4.0
Others	2	4.0
Total	50	100.0

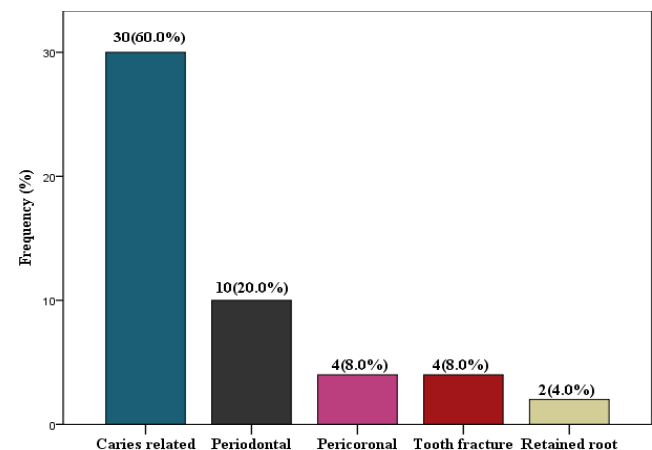


Figure 1: Sources of the fascia space infection among the participants



Figure 2: A young adult with Ludwig angina with a corrugated rubber *in situ*

Table 3: Duration of presentation for Treatment and Hospital stay

Duration (Days)	Presentation to the Hospital from onset of symptoms Days(%)	Duration of stay in the Hospital Days(%)
≤7	22(44.0)	30 (60.0)
8-14	16 (32.0)	13 (26.0)
15-31	5(10.0)	4(8.0)
31	7(14.0)	3(6.0)

Table 4: Treatment offered to fifty patients presenting with fascial space infection

Treatment	Frequency (n=50)	Percentage (%)
Empirical antibiotics +tooth extraction	173	4.0
Empirical antibiotics + tooth extraction +incision and drainage	23	46.0
Specific antibiotics + tooth extraction	0	0.0
Specific antibiotics + tooth extraction +incision and drainage	10	20.0

*Specific antibiotics given after bacterial culture

**Figure 3: Necrotising fasciitis in a patient****Table 5: Outcome of treatment given to fifty patients presenting with fascia space infection**

Treatment outcome	Frequency (n=50)	Percentage (%)
Complete resolution	32	64.0
Progression to necrotizing fasciitis	10	20.0
Mortality from Ludwig angina	5	10.0
Mortality from Necrotizing fasciitis	3	6.0

DISCUSSION

More than 90% of head and neck infections are caused by odontogenic pathology.[10] When odontogenic infections are not properly treated, they may spread to distant locations, causing more serious infections in fascial spaces and ultimately leading to deep neck infections.[11]

In our study the age group most commonly affected

was 31-40 years which is comparable to the study of Fating et al.[12] Conversely, Osunde reported prevalence in a younger age group (21-30 years).[13] Bross et al, however, observed higher frequency of deep neck infection in much older patients [14]. There was no significant gender difference in this study. However, studies by Osunde et al and Yousif et al showed higher prevalence among males.[13,15]

Lower third molars were found to be more frequently involved in this study when compared with other teeth. This agrees with the study of Flynn et al. [16] who reported 68% prevalence rate of Lower third molars, followed by other lower posterior teeth (premolars, first and second molars), without anterior teeth involvement. Hence, molar teeth removal remains one of the most regular dentoalveolar surgical procedures due to dental caries and its other complications.[17]

The leading cause of infection was dental caries-related sequelae (44%) in this study. This is similar to the findings of Yousif et al [15] who reported pulpitis(44%) as the major cause of fascia space infection. Purulent pulpitis which is a sequelae of dental caries spreads into the periapical space, therefore, it appears in the course of pulpal disease. In acute apical periodontitis there is an accumulation of pus inside the apical space of the tooth involved. This condition is commonly underestimated by dental practitioners in terms of its morbidity and mortality.[18] Other causes include peritonsillar or tonsillar abscesses, gunshot injuries and mandibular fractures.[19]

Submandibular space was identified as the major fascial space involved in this study. Marioni et al. [20] reported submandibular space infection involvement in (85.9%) of cases. Although the pattern of spread varies among patients, a relatively constant trend in the distribution of infection into the spaces seem to be evident. Some studies clearly demonstrated that the masticatory space is the most prevalent site for odontogenic infection spread.[21] Ludwig angina (simultaneous involvement of submandibular, sublingual, and submental spaces) was diagnosed in 22.0% in this study. This condition is defined as an aggressive and rapidly progressive infectious process that usually affects the airways and therefore can lead to death.[22] Yousif et al [15] reported Ludwig angina(48%) as the most predominant type of odontogenic fascial space infection in their study. This variation in the leading type of space infection may be due to anatomical variation and immune status in different individuals.

Most of the patients in the current study were medically fit (68%) and the most recorded compromised patients were diabetic (16.0%). All the eight cases of mortality recorded were diabetic. This finding underscores the importance of a thorough clinical assessment of the patient's overall condition, as the association between deep neck infections and conditions such as diabetes may increase the severity of infection, posing additional difficulties to treatment.[23] Furthermore, in patients with diabetes there is a defect of the cellular immunity complement activation and polymorphonuclear neutrophil function, which increase the risk of the episodes of infections.[4]

The basic principles guiding treatment of infection involving the fascial spaces include upper airway control, antibiotic therapy, and surgical drainage, usually performed at hospital emergency units.[24] Infectious etiologic agents

should be removed as soon as possible, so as to improve treatment outcomes.[24] Significant number(80%) of these patients responded to the empirical antibiotic regimen(Intravenous ceftriaxone 1g 12hourly, intravenousmetronidazole 500mg 8hourly and intravenous gentamycin 80mg 8hourly) and other treatment modalities including extraction of tooth , and incision and drainage or decompression as the case may be. The reason for the high level antibiotic regimen (Intravenous ceftriaxone 1g 12hourly, intravenous metronidazole 500mg 8hourly and intravenous gentamycin 80mg 8hourly) used was due to prior knowledge of abuse of low-level antibiotics which was common among the patients. Rao et al. [25] and Singh [26] respectively reported Amoxicillin as the most used antibiotics for these patients.

In this study 32(64%) patients had complete resolution which was a contrast to the study of Osunde and Yousif et al. who had less than half of their studied patients having complete recovery 48.8% and 40% respectively. All of the patients who had complete recovery had competent immunity. This high rate of successful treatment outcome recorded in our centre may be attributed to our treatment protocols for these type of patients which includes ; priority admission of all patients presenting with fascia space infection, administrations of high level intravenous antibiotics bearing in mind abuse of low level antibiotics which is common in the community we serve, prompt and aggressive surgical intervention which includes incision and drainage or decompression as the case may be, emergency tracheostomy when necessary, removal of implicated tooth or teeth.

Ten(20%) cases developed necrotizing fasciitis which is regarded as dangerous complication which is characterized by progressive destruction of fascia and adipose tissue that may not involve the skin. The reason for the progression was not clear.

We recorded eight(16%)cases of mortality all of which had underlying diabetic mellitus, five of these had Ludwig angina and three had progressed to necrotizing fasciitis. The cause of death was multiple organ failure resulting from septicaemia. Other contributory factors to fatalities from fascial space infection in the third world is malnutrition owing to poverty and delayed surgical intervention due to late presentation.[13]

CONCLUSION

Fascial space infection was more commonly found in the 4th decade of life with no significant gender predominance. Caries related infection involving the third molar was the major source of spread. The submandibular space was the most frequently affected fascial space. Mortality was only recorded in patients who had underlying diabetes mellitus. An aggressive and upgraded treatment protocol was helpful in improving the treatment outcome.

Conflict of interest

There is no known conflict of interest that could affect the outcome of this work

REFERENCES

1. Al-Mehedi A ,Chowdhury GM, Rab MA, Haider IA. Evaluation of efficiency of conventional antimicrobial

- regimen for the Management of Maxillofacial Fascial Space Infection JAFMC Bangladesh. 2015;11(2)47-54.
2. Topazian RG, Goldberg MH, Hupp JR . Oral and maxillofacial infections (4. ed.). Philadelphia: W.B. Saunders. 2002.p.188-213.
3. Mihos P, Potaris K, Gakidis I, Papadakis D, Rallis G. Management of descending ne-crotizing mediastinitis. J Oral MaxillofacSurg 2004;62(8)966-972.
4. Sharma k, Das D. Joshi M,Barma D, Sarma A. J. Deep Neck Space Infection- A study in Diabetic Population in a Tertiary Care Center. Indian J Otolaryngolo. Head Neck Surg 2018;70(1)22-27.
5. Estrera AS, Landay MJ, Grisham JM, Sinn DP, Platt MR. Descending necrotizing me-diastinitis. Surg Gynecol Obstet.1983;157(6)545-552.
6. Rubin MM, Cozzi GM. Fatal necrotizing mediastinitis as a complication of an odon-to-genic infection. J Oral MaxillofacSurg.1987;45.(1)529-533.
7. Zeitoun IM, Dhanarajani PJ. Cervical cellulitis and mediastinitis caused by odonto-genic infections: report of two cases and review of literature. J Oral MaxillofacSurg.1995;53(2)203-208.
8. Yonetsu K, Izumi M, Nakamura T. Deep facial infections of odontogenic origin: CT assessment of pathways of space involvement. AJNR Am J Neuroradiol 1998: 19(1): 123-128. 1998;19(1)123-128.
9. Ohshima A, Arijji Y, Goto M, Izumi M, Naitoh M, Kurita K, et al. Anatomical consid-erations for the spread of odontogenic infection originating from the pericoronitis ofimpacted mandibular third molar: computed tomographic analyses. Oral Surg OralMed Oral Pathol Oral RadiolEndod 2004;98(5)589-597.
10. Fragiskos D. Oral surgery. 1st ed. Berlin: Springer; 2007.p. 205–206 .
11. Hui-Hsin K, Wu-Chien C,Yen-Hung L, Chi-Hsiang C, Shih-Jung C Examining the correlation between diabetes and odontogenic infection: A nationwide, retrospective, matched cohort study in Taiwan 2017;12(6)e0178941
12. Fating NS, Saikrishna D, Vijay Kumar GS, Shetty SK, Raghavendra Rao M. Detection of Bacterial Flora in Orofacial Space Infections and Their Antibiotic Sensitivity Profile. J Maxillofac Oral Surg. 2014;13(4)525-532.
13. Osunde OD, Akhiwu BI, Efunkoya AA, Adebola AR, Iyogun CA, Arotiba JT. Management of fascial space infections in a Nigerian teaching hospital: A 4-year review. Niger Med J 2012;53(1)12-15.
14. Bross Soriano D, Arrieta Gómez J, Prado Calleros H, Schimelmitz Idi J, Jorba Basave S. Management of Ludwig's angina with small neck incisions: 18years experience. Otolaryngol Head Neck Surg. 2004;130(6)712-717.
15. Yousif I E, Amal HA, Israa B, Israa A, Israa M, Ala M. APattern of Odontogenic Fascial Space Infections among a Sample of Sudanese Patients Indian Journal ofDental Education. 2016;9(4):209-217.
16. Flynn TR, Shanti RM, Levi MH, Adamo AK, Kraut RA, Trieger N. Severe odontogenic infections, part 1: prospective report. J Oral MaxillofacSurg

- 2006;64(7)1093-1103.
17. Bergmann OJ. Oral infections and septicemia in immunocompromised patients with hematologic malignancies. *J Clin Microbiol.* 1988;26(10)2105-2109.
18. Robertson D, Smith AJ. The microbiology of the acute dental abscess. *J Med Microbiol* 2009;58(2)155-162.
19. Kurien M, Mathew J, Job A, Zachariah N. Ludwig's angina. *Clin Otolaryngol Allied Sci.* 2009;58(2)155-162.
20. Marioni G, Rinaldi R, Staffieri C, Marchese-Ragona R, Saia G, Stramare R, et al. Deep neck infection with dental origin: analysis of 85 consecutive cases (2000-2006). *Acta Otolaryngol* 2008;128(2)201-206.
21. Arijji Y, Gotoh M, Kimura Y, Naitoh M, Kurita K, Natsume N, et al. Odontogenic infection pathway to the submandibular space: imaging assessment. *Int J Oral Maxillofac Surg.* 2002;31(2)165-169.
22. AL Freddo, FV Gomes, CAM Martins, GG Fritscher, MA. Torriani Odontogenic infections: severe complications associated with diabetes mellitus *Rev Odonto Cienc* 2013;28(4)110-115.
23. Sennes LU, Imamura R, Angélico FV, Simoceli L, Frizzarini R, Tsuji DH. Infecções dos espaços cervicais: estudo prospectivo de 57 casos. *Rev Bras Otorrinolaringol.* 2002;68(3)88-93.
24. Zanini FD, Stefani E, Santos JC, Perito LS, Kruel NF. Angina de Ludwig: relato de caso e revisão do manejo terapêutico. *ACMArq Catarin Med* 2003;32(2)21-23.
25. Rao DD, Desai A, Kulkarni RD, Gopalkrishnan K, Rao CB. Comparison of maxillofacial space infection in diabetic and nondiabetic patients. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2010;110(4)7-12.
26. Singh M, Kambalimath DH, Gupta KC. Management of odontogenic space infection with microbiology study. *J Maxillofac Oral Surg* 2014;13(2)133-139.