

MICROBIAL FLORA AND ITS ANTIBIOTICS SENSITIVITY IN DIABETIC ODONTOGENIC CELLULITIS---A CASE SERIES

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ABSTRACT

Background: Facial spaces are potential planes in head and neck region between the fasciae and underlying organs or tissues. Infections involving these spaces may give varying signs and symptoms depending upon the area involved and sometimes potentially fatal if not managed promptly and adequately. The infections of odontogenic origin are mostly notorious for their spread to these potential spaces. The diabetic patients have shown special concerns as being aggressive in nature. **Objective:** To find out the types of microorganisms involved in odontogenic space infections in diabetic patients and their antibiotic sensitivity patterns. **Methodology:** A total of 300 diabetic patients with odontogenic cellulitis were selected for study in Oral and Maxillofacial Surgery Units of de'Montmorency College of Dentistry/ Punjab Dental Hospital Lahore and Nishtar Institute of Dentistry Multan from February 2017 to January 2019. A structured proforma was used to record patient's demographic data, type of tooth/teeth and fascial space involved in odontogenic infection and clinical and radiographic presentation of infected maxillofacial region. After ethical committee approval and consent of patients, the surgical decompression/drainage was performed mostly under local anesthesia and culture and sensitivity specimens were obtained for laboratory testing. **Results:** The mean age of patients was 44.50±14.38 years with male to female ratio of 1.16:1. The most common bacteria involved in odontogenic space infections in diabetic patients were staphylococci (31.3%) and the most sensitive antibiotic in diabetic odontogenic infections was levofloxacin (57.6%). **Conclusion:** The study shall be helpful to the clinicians in diabetic odontogenic infections management using levofloxacin with promising results.

KEYWORDS: Odontogenic infection, Diabetes, Microbial Flora, Antibiotic Sensitivity.

INTRODUCTION

The infections of orofacial region are commonly dental in origin and they are ranging from simple periapical abscess to severe infection involving the facial planes in head and neck region and may sometimes threaten the life of the patient.^[1] The microbiology of acute dental infections has been in the midst of many researches.^[2,3]

Studies show that the pyogenic infections are majority of odontogenic origin in head and neck region and their common causes are dental caries, pericoronitis, periodontitis, trauma or complications from dental procedures.^[4,5] The polymicrobia are the hallmark of these infections and the studies indicate that the commensal facultative bacteria of the oral flora are major part of the polymicrobia.^[6]

Odontogenic infections range from periapical abscesses to superficial and deep infections in head and neck region. Among these, some infections resolve with little consequences whereas others lead to severe life threatening sequelae.^[7] The self-medication and frequent use of antibiotics may cause bacterial resistance and poor response to drugs. Patients with odontogenic space infections sometimes have associated systemic comorbidities such as diabetes mellitus and other debilitating diseases which usually result in impaired host defense.^[8] The acute dental abscess is usually underestimated in terms of its morbidity and mortality by general dental practitioners. The potential serious consequences arising from the spread of dental infection in diabetic patients are still relevant in hospital admissions today. Despite of the reports of increasing antimicrobial resistance in isolates from acute dental infection, the vast majority of localized dental abscesses respond to surgical treatment and limit antimicrobials to spreading the severe infections.^[9]

The study was carried out to find out the types of microbial flora and their antibiotic sensitivity in isolates of odontogenic cellulitis in diabetic patients. The already published researches have provided great input but the local data is lacking. This study provides local evidence of the most prevalent organisms involved in orofacial space infections and the most effective antibiotics for odontogenic infections in diabetic patients. This will also

improve our services of dental practice and will provide local guidelines to manage diabetic patients with odontogenic infections by dental practitioners.

PATIENTS AND METHODS

The cross sectional non-probability sample study was conducted in Oral and Maxillofacial Surgery Departments of two public sector dental institutions of Punjab province of Pakistan i.e. de'Montmorency College of Dentistry/ Punjab Dental Hospital Lahore and Nishtar Institute of Dentistry Multan from February 2017 to January 2019. Ethical approval was taken from ethical committees of the institutions. Three hundred diabetic patients of age 20 to 70 years of both genders were studied with orofacial odontogenic facial space infections. The isolates were obtained from site of infection with bacteria > 10cells/hpf in sterilized culture and sensitivity tubes. Patients already on antibiotics and immunocompromised e.g. on steroids and immunotherapy were excluded from the study. A written informed consent from every patient was taken after explaining risks and benefits of incision and drainage/decompression. The patients underwent surgical decompression/drainage mostly under local anesthesia in aseptic conditions. The specimens (pus/exudates) were collected by aspirating with 23 gauge needle in a syringe (Fig. 1).



Fig. 1: A. Aspirated Pus/ Exudate. B. Culture and Sensitivity Tubes.

The sample was immediately injected in two separate bottles with air tight lids containing a nutrient broth and thyoglycollate media for aerobic and anaerobic microflora to incubate respectively and the part of the sample was used to prepare slides for microscope to evaluate type of microorganisms. The secured specimens were transported to pathological laboratory within an hour for processing along with recorded proforma. All patients were observed post-surgical for 06 hours and an

empirical antibiotic therapy (Amoxicillin with Clavulanic Acid) was immediately started intravenously till the culture and sensitivity report was obtained for specific antibiotics protocol. A structured questionnaire was used to record all the data e.g. patient's history, demographic details, presenting complaint, predisposing factors to odontogenic infection, type of tooth, fascial space and microbial flora involved.

Pus specimen was examined for the types of bacteria e.g. Aerobic Staphylococcus Spp, St. Aureus, Enterobacter Spp, E. Coli, Hemolytic Streptococcus Pneumoniae, Pseudomonas Aeruginosa, Klebsiella Pneumoniae. The pus sample showing $>10^5$ organisms, were considered significant source whereas the drug sensitivity was labeled as "Positive" if the organisms responded to a particular antibiotic. The antibiotics ceftriaxone, levofloxacin, amoxicillin with clavulanic acid, ampicillin, cefaclor, cefazolin, vancomycin, cephalixin, gentamycin, erythromycin and ceftazidime were used in the medium to check the drug sensitivity for 72 hours and then the empirical antibiotics were replaced by the specific sensitive antibiotics to treat the patients.

All the data were collected and entered in IBM SPSS version 21 and analyzed through its statistical package. Frequency distributions and percentages for all the variables were worked out and results were analyzed and presented in tables, graphs and charts accordingly. Quantitative variables like age, number of bacteria and duration of infection were calculated in mean and standard deviation whereas the qualitative variables like gender, type of bacteria and type of antibiotics were assessed in frequency and percentage. Chi-square test was applied to compare the qualitative variables. P value ≤ 0.05 was considered significant.

RESULTS

Out of total 300 patients, 53.66% were male patients and 46.33% were females with male to female ratio of 1.16:1

Table I: Primary Jaw Involvement of Patients.

Primary Jaw Involved	Male n(%)	Female n(%)	Total n(%)
Maxillary Infection	39 (24.22%)	25(17.98%)	64(21.33%)
Mandibular Infection	122 (75.77%)	114(82.01%)	236(78.66%)
Total	161	139	300

The sensitivity was highest with Levofloxacin 173 (57.66%). Vancomycin and ampicillin, both were sensitive in 126 (42%), Amoxicillin alone showed sensitivity in 121 (40.3%) and with Clavulanic acid was

(Fig. 2). The age range of patients was 20 to 70 years with a mean age (\pm SD) of 44.50 ± 14.38 years.

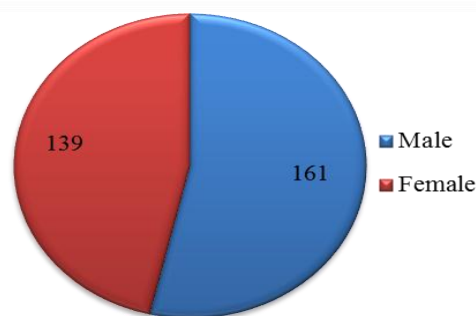


Fig. 2: Gender Distribution of Patients

The mean duration of infection (\pm SD) of patients was 11.57 ± 2.27 days. In this study, 204 (68%) patients were non-smokers whereas 96 (32%) patients had tobacco smoking history. The study showed that 94 (31.3%) patients had Staphylococci, 65 (21.66%) patients had Klebsiella, 57 (19%) patients had E. coli, 36 (12%) patients had Enterococcus bacteria, 19 (6.3%) patients had Streptococcus, 14 (4.6%) patients had Pseudomonas bacteria, and 12 (4%) patients had Fusobacterium whereas Actinomycetes were in 03 (1%) patients. Involvement of maxillary and mandibular jaw in study population is shown in Table I.

sensitive in 124(41.3%) patients. Relative distribution of antibiotic sensitivity in different patients is given in Table II.

Table II: Sensitivity of Microbial Flora to Antibiotics.

Drug Sensitivity	Frequency (n)	Percent (%)
Levofloxacin	173	(57.6%)
Cefazolin	137	(45.6%)
Cefaclor	133	(44.3%)
Ceftriaxone	131	(43.6%)
Erythromycin	128	(42.6%)
Vancomycin	126	(42%)
Ampicillin	126	(42%)
Amoxicillin	121	(40.3%)
Clavulanic acid	124	(41.3%)
Gentamycin	121	(40.3%)
Cephalexin	114	(38%)
Ceftazidime	110	(36.6%)

The relative distribution of patients with respect to involvement of different fascial spaces by odontogenic infection in the current study is shown in Table III. Out of total 300 patients, 161 had involvement of right sided spaces while 139 had involvement of left side. In case of Ludwig's Angina the more predominantly involved side was labeled as right or left.

Table III: Frequency of Involved Fascial Spaces.

Space Involved	Right Side	Left Side	Total
Buccal	19	14	33
Canine	21	11	32
Submaxillary	44	65	109
Sublingual	24	18	42
Submental	08	07	15
Pterygomandibular	12	07	19
Temporal	09	06	15
Submasseteric	15	08	23
Ludwig's Angina	08	03	11
Lateral Pharyngeal	01	00	01
Total	161	139	300

DISCUSSION

Odontogenic infections have long history in human beings and various modalities had been used for their

management. With the advances and inventions in medical sciences, the diagnosis and management protocol of diseases have been remarkably improved. Modern antibiotics have played inevitable role in management of these odontogenic infections but still they have not been succeeded in eradicating bacterial infections.^[10] Generally, in the orofacial region, most bacterial infections involve either a disturbance of the normal flora or a deployment of the organisms to the site, where they are usually not present. The results of our study are promising in type of organisms involved and much similar in diabetic patients presenting with orofacial infections studies that the Staphylococci were highest (31.3%), followed by Klebsiella (21.6%) and other organisms were Escherichia coli, enterococcus bacteria, streptococci, pseudomonas, fusobacterium, actinomycetes.^[11-14]

The male to female ratio is not comparable to most of the other studies outside the country whereas the age is relatively comparable.^[2,15-17] The mandibular jaw is more involved comparative to the maxilla in our study and results are supported by the other studies. One important issue is that multiple spaces are more involved in our study patients along with, more in mandibular area and results are well supported.^[21]



Fig. 4: A. Pre-operative status of a patient with diabetic odontogenic cellulitis of buccal, canine, submaxillary, infra-temporal and submasseteric space. B. Post of status of the same patient.

In other, *Streptococcus viridans* were seen in 36.4%, non-hemolytic Staphylococci were seen in 9.1%, Klebsiella in 27.3%, Pseudomonas Aeruginosa in 18.2%, and Enterobacter Spp in 4.54%, again favoring our study results. Whereas, percentage of the type of bacteria involved is not comparable to our study.^[21,22] Rega et al study the gram-positive cocci were most frequent infectious microorganisms in the orofacial region infections. Bartlett and O'Keefe also supported Rega and our study.^[22,23]

The antibiotic sensitivity was observed somewhat similar to other studies that is bacteria flora was more sensitive to Ceftriaxone (95.4%), Levofloxacin (90.9%), Amoxicillin (80.3%), followed by Clavulanic acid (57.5%), Cefaclor (45%), Cefazolin (42.4%), Vancomycin (47.1%), Cephalexin (53%), Gentamycin (9.7%), Erythromycin (53%), Ceftazidime (57.6%) and Ampicillin (13.6%).^[24]

In this study the most sensitive antibiotic for orofacial space infections of odontogenic origin in diabetic patients was levofloxacin (53.1%) followed by Cefazolin

(52.7%), Cefaclor, Vancomycin, Ceftriaxone, Amoxicillin, Erythromycin and least with Ampicillin. Whereas, another study shows the antibiotic sensitivity to bacteria with Ceftriaxone is 95.4%, followed by Levofloxacin 90.9%, amoxicillin 80.3%, and with clavulanic acid 57.5%, cefaclor 4.5%, cefazolin 0% (42.4% resistive), vancomycin 47.1%, cephalixin 53%, gentamycin 19.7%, erythromycin 53% and Ceftazidime 57.6%, ampicillin 13.6% and divergent to our study.^[21,25] Rahul D. Kamat *et al* show that the satisfactory resolution of infection was seen following surgical drainage with adjuvant antimicrobial therapy consisting of Amoxicillin/Clavulanic acid and Metronidazole, with strict glycemic control.^[8,26]

CONCLUSION AND RECOMMENDATIONS

The study shows that the early middle age diabetic patients are involved in odontogenic space infection with more involvement of lower jaw. Whereas, the most common type of microbial flora is Staphylococcus species followed by Klebsiella and others. The common effective antibiotic is Levofloxacin followed by Cefazolin. The strict glycemic control was mandatory to avoid secondary spaces involvement and to get better antibiotic efficacy.

REFERENCES

- Mathew GC, Ranganathan LK, Gandhi S, Jacob ME, Singh I, Solanki M, *et al.* Odontogenic maxillofacial space infections at a tertiary care center in North India: a five-year retrospective study. *Intern J Infect Dis*, 2012; 16: 296-302.
- Yuvaraj V, Alexander M, Pasupathy S. Microflora in maxillofacial infections-a changing scenario? *J Oral Maxillofac Surg*, 2012; 70: 119-25.
- Patankar A, Dugal A, Kshirsagar R, Hariram, Singh V, Mishra A. Evaluation of microbial flora in orofacial space infections of odontogenic origin. *Natl J Maxillofac Surg*, 2014; 5: 161-5.
- Huang TT, Liu TC, Chen PR, Tseng FY, Yeh TH, Chen YS. Deep neck infection: analysis of 185 cases. *Head Neck*, 2004; 26: 854-60.
- Uluibau IC, Jaunay T, Goss AN. Severe odontogenic infections. *Aust Dent J*, 2005; 50: 74-81.
- Kityamuwesi R, Muwaz L, Kasangaki A, Kajumbula H, Rwenyonyi CM. Characteristics of pyogenic odontogenic infection in patients attending Mulago Hospital, Uganda: a cross-sectional study. *BMC Microbiol*, 2015; 15: 1-10.
- Fating NS, Saikrishna D, Kumar GSV, Shetty SK, Rao MR. Detection of bacterial flora in orofacial space infections and their antibiotic sensitivity profile. *J Maxillofac Oral Surg*, 2014; 13: 525-32.
- Kamat RD, Dhupar V, Akkara F, Shetye O. A comparative analysis of odontogenic maxillofacial infections in diabetic and nondiabetic patients: an institutional study. *J Korean Assoc Oral Maxillofac Surg*, 2015; 41: 176-80.
- Robertson D, Smith AJ. The microbiology of the acute dental abscess. *J Med Microbiol*, 2009; 58: 155-62.
- Topazian RG, Goldberg MH, Hupp JR, editors. 4th ed. Philadelphia: WB Saunders Oral and Maxillofacial Infections, 2002; 99-213.
- Patil S, Rao RS, Sanketh DS, Amrutha N. Microbial Flora in Oral Diseases. *J Contemp Dent Pract*, 2013; 14: 1202-8.
- Marsh PD. Role of the oral microflora in health. *Microbial Ecology in Health and Disease*, 2000; 12: 130-37.
- Lemonick DM. Ludwig's Angina: Diagnosis and treatment. *Hospital Physician*, July 2002; 31-37.
- Duprey K, Rose J, Fromm C. Ludwig's angina. *Int J Emerg Med*, 2010; 3: 201-202.
- Goldberg MH. The changing biologic nature of acute dental infection. *J Am Dent Assoc*, 1970; 80: 1048-51.
- Dodson TB, Perrot DH, Kaban LB. Pediatric maxillofacial infections: a retrospective study of 113 patients. *J Oral Maxillofac Surg*, 1989; 47: 327-30.
- Kohli M, Mathur A. In vitro evaluation of microbiological flora of orofacial infections. *J Maxillofac Oral Surg*, 2009; 8: 329-33.
- Wang J, Ahani A, Pogrel MA. A five-year retrospective study of odontogenic maxillofacial infections in a large urban public hospital. *Int J Oral Maxillofac Surg*, 2005; 34: 646-49.
- Flynn TR, Shanti RM. Severe odontogenic infections, part 1: prospective report. *J Oral Maxillofac Surg*, 2006; 64: 1093-1103.
- Rao DD, Desai A. Comparison of maxillofacial space infection in diabetic and nondiabetic patients. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*, 2010; 110: 7-12.
- Santosh AN, Viresh AN, Sharmada BK. Microbiology and antibiotic sensitivity of odontogenic space infection. *Int J Med and Dent Sci.*, 2014; 3: 303-13.
- Bahl R, Sandhu S, Singh K, Sahai N, Gupta M. Odontogenic infections: Microbiology and management. *Contemp Clin Dent*, 2014; 5: 307-11.
- Rega AJ, Aziz SR, Ziccardi VB. Microbiology and antibiotic sensitivities of head and neck space infections of odontogenic origin. *J Oral Maxillofac Surg*, 2006; 64: 1377-80.
- Bartlett JG, O'Keefe P. The bacteriology of perimandibular space infections. The bacteriology of perimandibular space infections. *J Oral Surg*, 1979; 37: 407-9.
- Ellison SJ. The role of phenoxymethylpenicillin, amoxicillin, metronidazole and clindamycin in the management of acute dentoalveolar abscesses—a review. *Br Dent J*, 2009; 206: 357-62.
- Gilmore WC, Jacobus NV, Gorbach SL, Doku HC, Tally FP. A prospective double-blind evaluation of penicillin versus clindamycin in the treatment of odontogenic infections. *J Oral Maxillofac Surg*, 1988; 46: 1065-70.