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# Antibiotic evaluation of odontogenic microbiological spectrum of orofacial infection

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## ABSTRACT

The aim of this study was to investigate the microbial flora and simultaneously evaluate its antibiotic response in patients associated with odontogenic infection. Samples for the analysis were taken from the Maxillofacial Surgery Department of People's Dental Academy, People's University, Bhopal. Our results resemble with current knowledge of odontogenic microbial flora. In this study frequently isolated isolates were 40(51%) of *Staphylococcus aureus*, 65(83%) of *Streptococcus mutans*, 23(29%) of *Streptococcus salivarius*, 30(38%) of *Streptococcus sanguis*, 21(27%) of *Streptococcus mitis*, 17(22%) of *Pseudomonas aeruginosa* and 14(18%) *Klebsiella pneumoniae*. The average sensitivity of antimicrobials against all isolated organisms were studied and it was found that common sensitive antimicrobials were clindamycin (88%), Metronidazole (79%), cefotaxime (72%), linezoid (72%), erythromycin (72%), amoxclave (71%), ornidazole (67%), ciprofloxacin (67%), vancomycin (65%), imipenum (64%), cefadroxil (59%), ceftazidine (59%), azithromycin (58%), cefoperazone sulbactum (56%), where as resistant antimicrobials were penicillin (83%), levofloxacin (79%), gentamycin (77%), penicillin G (72%), cefuroxime (72%), ceftriazone (65%), ampicillin (65%), amikacin (64%), norfloxacin (59%), piperacillin (56%), clarithromycin (55%), ofloxacin (55%), ampicillin sulbactam (51%), azithromycin (50%), ampicillin sulbactum (50%), ceftazidine (50%). To attain maximum antimicrobial effect and minimal risk, clinical analysis and efficacy of antibiotics with regards to isolated bacteria is of great importance. Thus it indicates that microbiological analyses have significance in clinical diagnosis whereas evaluation of antibiotic susceptibility helps clinician to opt appropriate antibiotic regime for suffered patient.

**Keywords:** Orofacial infection, Odontogenic infection, Dental abscess, Microbiology, Antibiotics.

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## INTRODUCTION

Odontogenic infections are those which frequently occur in the pulp, periodontium or periapex of the tooth and mainly attributed due to normal flora of the mouth, whereas non odontogenic infections occur due to penetration of organisms through skin or mucous membrane and depend on the type and site of infection[1]. The acute dental abscess is very much underestimated in terms of its morbidity and mortality. One of the commonest and major problems encountered in dental practice is bacterial infections. The most varied and vast flora in entire human body harbors in oral cavity in which dental abscess is usually polymicrobial which majorly includes *alpha-haemolytic streptococci*, coagulase negative *Staphylococci*, *Staphylococcus epidermidis*, *Staphylococcus aureus*, *Streptococcus viridans* group, *Streptococcus anginosus* group, and strict anaerobes like *Prevotella, anaerobic cocci*, *Fusobacterium* species. Pain, swelling, erythema, suppuration are characteristic features of dental abscess [2-3].

The pathologic progression of this disease is a necrotic inflammation of pulp which extends in form of dentoalveolar abscess into periapical area and may penetrate through cortical bone to involve possible spaces[4]. Odontogenic infections usually react well to dental care, surgical intervention and antimicrobial therapy is essential for the speedy resolution of infection[5]. This study explores bacterial isolates in patients with odontogenic infection and its antibiotic susceptibility to different antibiotics which may commonly prescribe as prophylaxis in such types of infection in odontology.

## MATERIALS AND METHOD

This study was conducted in People's Dental Academy, People's University, Bhopal. All patients presenting with maxillofacial infection in outpatient of the department were thoroughly screened with complete case history and detailed examination. The cases diagnosed as having maxillofacial infection was carried out in study whereas patients presenting with wound sepsis, history of anti-cancer chemotherapy or any other additional co-morbidity such as chronic renal failure, severe anemia and administration of antibiotic within a week were excluded from the study.

### Collection of pus sample

Pus sample was preferentially collected by closed aspiration using an 18 gauge needle and 10 mL disposable syringe. Site of aspiration was chosen after careful examination and before aspiration it was cleaned with isopropyl alcohol. Intra-oral site was cleaned using 0.2% chlorhexidine mouth rinse, subsequently sterile dry gauze was used to wipe the area. Maximum amount of sample was aspirated in a single attempt to avoid contamination. In cases where significant aspirate was not available after incision and drainage, the sample was collected by sterile culture swabs. Immediately upon aspiration residual air was evacuated from the syringe and the needle was capped with a sterile rubber cork. The samples were transported to laboratory without any delay.

### Assessment of microbial profile

Pus samples were directly observed by gram staining as well as it is processed on appropriate culture media for isolation and identification of micro-organisms. All culture media used in the study was prepared by reconstituting the commercially available dehydrated media of HiMedia, India. Samples were inoculated on blood agar, MacConkey agar media at 37°C for 18-24 hrs of incubation. After growth appears on media smear was prepared and Gram staining was performed to study morphologic characteristics followed by various biochemical tests for identification of micro-organisms.

### Antibiotic susceptibility testing

Isolated and identified colonies were then inoculated on Muller Hinton Agar for growing organisms. Antibiotic sensitivity for isolates was done by standard Kirby-Bauer Disk Diffusion Technique. Interpretations were carried out based on the diameter of the zone of inhibition as sensitive, moderate sensitive or resistant using manual provided by Himedia Pvt. Ltd., India. Antibiotics used were Amoxicillin-Clavulanic acid, Ampicillin, Ampicillin-Sulbactam, Cefadroxil, Clarithromycin, Clindamycin, Linezolid, Norfloxacin, Azithromycin, Vancomycin, Amikacin, Cefoparazone-Sulbactam, Cefotaxime, Ceftazidine, Ceftriaxone, Cefuroxime, Ciprofloxacin, Erythromycin, Gentamycin, Imipenen, Levofloxacin, Penicillin G, Metronidazole, Ornidazole and Ofloxacin.

## RESULTS AND DISCUSSION

In our study 78 patients with maxillofacial odontogenic infection (Table 1) were included which were fulfilling the inclusion and exclusion criteria's of the study and 30 samples were taken of control (Healthy individuals). In the gender distribution of the subjects (Table1) it was observed that out of 78 patients the females were 37(47.4%) and males were 41(52.5%). In control group out of 30 individuals 15 females and 15 males were enrolled. These findings were also be compared with gender distribution in which out of 90 patients 57(63.33%) cases were of males and 33(36.67%) cases were of female, In some studies male patients were 54% and female patients were 46% and 56(70%) were males and 24(30%) were female[6-8]. In our study also male patients was higher than females patients, thus males are much prone to the infection rather than females.

**Table 1: Gender wise distribution**

| S No | Gender | No. of Patients (%) (n= 78 ) | Control Group (n=30) |
|---|---|---|---|
| 1 | Male | 41 (52.5%) | 15 |
| 2 | Female | 37(47.4%) | 15 |

In the abscess distribution by tooth type (Table 2) it has been found that out of 78 patients the total 190 teeth were affected in which 108(57%) teeth are of molars, 16(8%) are canines and 33(17%) are premolars and incisors tooth (Table 2). No teeth were involved in control group. The most frequently implicated teeth were those located in the lower posterior segments (61.5%), followed by the lower molars (26.6%). In other study they found the lower molars to be the most causal teeth [9].

**Table 2: Abscess distribution by tooth type**

| S.No. | Tooth type | No. of cases | No. of tooth involving | Percentage (%) | Control group |
|---|---|---|---|---|---|
| 1 | Molars | 62 | 108 | 57% | 00 |
| 2 | Premolars | 20 | 33 | 17% | 00 |
| 3 | Canines | 10 | 16 | 08% | 00 |
| 4 | Incisors | 13 | 33 | 17% | 00 |
| | **Total** | **105** | **190** | **100** | **00** |

In some studies also stated that most odontogenic infections arise as a sequel to pulp necrosis caused by caries, periodontal infections, gingivitis, pericoronitis, trauma and surgery are other sources responsible for orofacial infections. In our study also it was observed that the main origin/cause of odontogenic infection (Table 3) was dental caries i.e 62 (79.4%), followed by gingivitis 44(56.4%), periodontitis 30(38.4%), periapical 5(6.4%) and pericoronitis 3(3.8%). Local odontogenic infections usually originate from apical periodontitis (66.7%-70.7%) or initially from dental caries (33.8%-80.6%). Other dental

diseases causing local infection complications are pericoronitis, alveolar osteitis, periodontitis and cysts [8-15].

**Table 3: Origin of infection**

| S.No | Origin of infection | No. of patients (%) | Control Group |
|---|---|---|---|
| 1 | Periodontal | 30 (38.4%) | 00 |
| 2 | Pericoronitis | 03 (03.8%) | 00 |
| 3 | Periapical | 05 (06.4%) | 00 |
| 4 | Dental caries | 62 (79.4%) | 00 |
| 5 | Gingivitis | 44 (56.4%) | 00 |

It was observed that in total 78 abscess patients (Table 4) there was 40(51%) of *Staphylococcus aureus* isolates, 65(83%) of *Streptococcus mutans*, 23(29%) of *Streptococcus salivarius*, 30(38%) of *Streptococcus sanguis*, 21(27%) of *Streptococcus mitis*, 17(22%) of *Pseudomonas aeruginosa* and 14(18%) are of *Klebsiella pneumoniae*. Total isolates were 210 in odontogenic patients in which multiple isolates are found in single patient. Studies by some scientists covering diverse populations and performed at different time periods show that maxillofacial infections are polymicrobial mixed micro flora[16-21]. The most common micro-organisms in dentoalveolar infection is *Streptococcus viridans* [22]. The results of our study are in concurrence with those of Rega (2006) et al and Rao D et al (2010)[7, 23]. In many studies it was found that *Staphylococci* are now more frequent colonizer of oral tissues than previously thought. The frequent isolation of *Staphylococci* in pus samples from odontogenic infections have been reported in previous studies [19,24]. The most common organisms isolated from aerobic bacteria were *Streptococcus viridans* 24(36.4%), followed by *Klebsiella* 18(27.3%), *Pseudomonas aeruginosa* 12(18.2%), coagulase negative *Staphylococci* 6(9.1%), *Nisseria* 3(4.54%) and *Enterobacter* spp. 3(4.54%)[6]. The isolation of *pseudomonas* in 13 cases (11.60%) is high when compared to other studies[10].

**Table 4: Isolates from patients (n=78)**

| S No. | Isolates | No. of isolates (%) | Control (%) |
|---|---|---|---|
| 1 | *Staphylococcus aureus* | 40 (51%) | 12 |
| 2 | *Streptococcus mutans* | 65 (83%) | 28 |
| 3 | *Streptococcus salivaris* | 23 (29%) | 25 |
| 4 | *Streptococcus sanguis* | 30 (38%) | 07 |
| 5 | *Streptococcus mitis* | 21 (27%) | 15 |
| 6 | *Pseudomonas aeruginosa* | 17 (22%) | 04 |
| 7 | *Klebsiella pneumonia* | 14 (18%) | 02 |
| | **Total Isolates** | **210** | **93** |

The average of antimicrobials activity against all different isolates in which sensitive antimicrobials (Figure 1) are clindamycin (88%), metronidazole (79%), cefotaxime (72%), linezoid (72%), erythromycin (72%), amoxclave (71%), ornidazole (67%), ciprofloxacin (67%), vancomycin (65%), imipenum (64%), cefadroxil (59%), ceftazidine (59%), azithromycin (58%), cefoperazone sulbactum (56%). A total of 27 antibiotics were tested in the present study. Over all excellent responses were evident for Clindamycin, Linezolid and Metronidazole, Cefotaxime, Erythromycin. Baumgartner et al. 2003, Chang et al. 2005 also reported the high sensitivity for clindamycin[25-26], while Lewis M et al (1990) and Boyanova et al (2006) reported Clindamycin and Metronidazole to be highly efficient against gram negative rods[17,27]. Salins BM et al (2006) have also shown high susceptibility for Linezolid and Clindamycin[28]. Gutierrez-Perez JL et al (2004) who recommended Amoxicillin-Clavulanic acid as the first line antibiotic, our study found an antibiotic sensitivity on 70.5% to this antibiotic[29]. *In-vitro* susceptibility (88.46%) to Clindamycin and the clinical response to this antimicrobial in the present study appears to justify its choice as the first line drug for odontogenic sepsis. In the study of Flynn TR (2000) all the aerobic bacteria showed 3(14.3%) sensitive to Ampicillin and 10(47.6%) resistance to the same. Most of the organisms were sensitive to Ceftriaxone 20(95.2%), Levofloxacin 19(90.5%) and 17(81%) sensitive for Amoxicillin and Clavulanic acid[5].

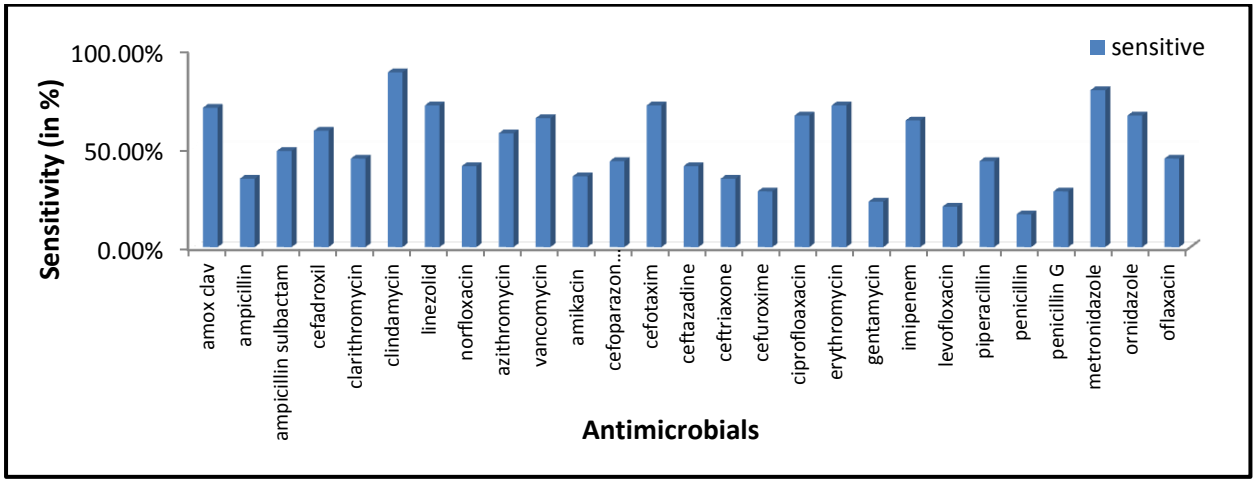

**Figure 1 Antimicrobial profile (Average) of all isolates**

## CONCLUSION

Management of odontogenic infection should consider the therapeutics success which lies in control of infection whether by using mechanical surgical debridement or by antimicrobial therapy. Microbiological analysis is one of the reliable way to define therapeutic success by precisely characterize prognosis of recurrence and is enable to select most appropriate antibiotic therapy to increase therapeutic efficacy.

In context of our study, good oral health continues to be critical in prevention and treatment of severe odontogenic infections. It requires more profound awareness by society and health care professionals. The result of this study will hopefully deepen our knowledge of the odontogenic infection that can help to improve our understanding which could be applied clinically.

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