Evaluation of microbial flora in orofacial space infections of odontogenic origin

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ABSTRACT

Background: The microbiology of acute dental infections has been in the midst of many researches. Various bacteriological studies show variations in their conclusion. The purpose of our study was to evaluate the microbial flora in orofacial space infections of odontogenic origin, which is essential for appropriate antibiotic selection. Materials and Methods: Thirty-five patients with odontogenic infection causing fascial space involvement were included. Aspirated specimen was transported in nutrient broth and thyoxyglycollate media within an hour for further culture and sensitivity testing. Result and Conclusion: This study indicates that orofacial odontogenic infections are usually polymicrobial, consisting of a complex mixture of both anaerobes and aerobes.

Key words: Acute dental infection, odontogenic infection, microbial flora fascial space infection, orofacial infection

INTRODUCTION

Infections in the orofacial region are commonly known to be of dental origin. Odontogenic infections range from simple periapical abscesses to severe infections involving superficial and deep fascial spaces in the neck often leading to septicemia.

The microbiology of acute dental infections has been in the midst of many researches. Various bacteriological studies show variation in their conclusions. The difference between reports undoubtedly reflects variations in the bacteriological techniques employed for their isolation and identification and may be due to gradual changes in flora due to injudicious use of antimicrobials.

The knowledge of common pathogens and resistance status can guide the clinician towards appropriate selection of empirical antibiotics. But on reviewing the available literature it has been observed that not many studies have been conducted in Indian population to list the common pathogens causing orofacial infections. Considering the above facts, this study was designed to obtain valuable information of the laboratory data regarding the microorganisms causing odontogenic infections in local population.

MATERIALS AND METHODS

The study was conducted as a prospective study.

Inclusion criteria

- Patients of all age groups, with moderate to severe odontogenic fascial space infections
- Patients not allergic to penicillin.

Exclusion criteria

- Patients receiving antibiotic therapy more than 24 h prior to reporting to outpatient department (OPD)
- Patients having a recent history of major illness or hospitalization for more than a week
- Immunocompromised patients (e.g. steroids therapy and human immunodeficiency virus (HIV)).

Thirty-five patients who fulfilled the criteria were included.
The routine case history, clinical examination, and preanesthetic evaluations were carried out before these patients underwent surgical decompression/drainage either under local anesthesia or under general anesthesia.

Usual painting and draping was carried out in all the cases. The specimen (pus/exudates) was collected by aspiration with 18 gauge needle in a syringe with routine aseptic precautions before drainage. The needle was closed immediately with the plastic cap to avoid contamination. Then part of this sample was immediately injected in two separate bottles with air tight corks, containing a nutrient broth and thioglycollate media for aerobic and anaerobic microflora, respectively [Figure 1]. The remaining part of the sample form the syringe was used to prepare slides to examine the microorganisms under the microscope. The samples were sent to laboratory within an hour for further processing.

The surgical drainage/decompression was carried out under local anesthesia or general anesthesia, and drains were placed intraorally/extraorally as required. Postoperatively all the patients were maintained on intravenous (i.v.) cephataxime (1 g tid) till culture report was obtained and after that the specific antibiotics were started if necessary.

In the laboratory following steps were done to confirm the microflora from the sample.

A. Steps for aerobic organisms identification: Assay time/turnaround time - 2 days
   - The pus sample was aseptically plated on blood agar plate and on MacConkey’s agar plate to make a primary well. Subsequently spreading was done by a nichrome wire loop
   - Both the plates were streaked aseptically
   - Incubation was done for both the plates under aerobic conditions at 37°C for 24 h

   • The colonies on both the plates were noted. Blood agar plate was used for all organisms and MacConkey’s agar plate was for gram negative organisms
   • Blood agar and MacConkey’s agar plate were examined especially for the presence of following organisms: Staphylococcus aureus, Streptococcus, Klebsiella sp., and Pseudomonas aeruginosa
   • The morphology was confirmed with gram staining.
   • The identification of organism was done by biochemical tests and antimicrobial susceptibility testing was done by Kirby-Bauer method.

B. Steps for anaerobic organisms identification: Assay time/turnaround time - 5 days
   - The pus sample in thioglycollate broth was inoculated in the same and incubated at 37°C overnight
   - Subculture was done on blood agar and it was immediately put in an anaerobic biobag with indicator. The bag was sealed with parafilm. Incubation was done at 37°C for 48 h
   - The growth colonies were observed and described. Gram smear was done. Aerotolerance testing was done. If the colony grows on aerobic culture, it is unlikely to be an obligate anaerobe. (except Clostridium septicum and Actinomyces)
   - If no growth occurs on aerobic culture, the organism is presumptively identified by means of gram reaction, colony characters, and available biochemical tests. If required antimicrobial susceptibility is done on blood agar with disc diffusion technique.

Results

Of the 35 patients evaluated in this study, 18 were female and 17 were male. The highest incidence was seen in the age group of 21–30 years. The maxillary teeth were predominantly involved (66%) as a source of odontogenic infections and the highest incidence of involvement of spaces were of buccal (41%) and submandibular (31%) spaces [Figures 2 and 3].

Out of 35 patients studied, 27 patients showed mixed infection. While five and three patients showed anaerobic and aerobic infection, respectively [Figure 4].
In our study, gram positive organisms were predominantly isolated as compared to gram negative organisms. Cocci were predominantly isolated as compared to rods. Aerobic and anaerobic organisms were nearly equal in number [Figures 5-7].

The incidence of isolation of anaerobic Streptococci was highest, followed by *Staphylococcus aureus*. The other organisms isolated were *Escherichia coli*, nonhemolytic Streptococci, *Klebsiella pneumoniae*, and *Pseudomonas aeruginosa* in minor percentages [Table 1 and Figure 8].

In six patients antibiotics were changed according to the culture and sensitivity reports.

| Microorganism Isolated                  | Instances | Percentage |
|-----------------------------------------|-----------|------------|
| Anaerobic streptococci                  | 17        | 48         |
| *Staphylococcus aureus*                 | 11        | 31         |
| *Escherichia coli*                      | 03        | 9          |
| Non haemolytic streptococci             | 01        | 3          |
| *Klebsiella pneumoniae*                 | 01        | 3          |
| *Pseudomonas aeruginosa*                | 02        | 6          |

**Discussion**

For many years, the reported microbiology of odontogenic infections was inconsistent. It was difficult to compare various bacteriological investigations because of differing methods and materials used. But over a period of time, its polymicrobial nature and the changing nature of species has been noted and reported.

The pus/exudate was collected by aspiration with 18 gauge needle in a syringe with routine aseptic precautions to avoid air/surface contamination. In present study we used thioglycollate broth as it permits growth of anaerobic bacteria. The oxygen levels throughout the media are reduced via reaction with sodium thioglycollate which allows differentiation of aerobic, anaerobic, microaerophilic, and facultative anaerobic organisms based upon growth at various oxygen levels in the media.

Total number of isolates in our study was 35, with the mean number of 1 isolates per sample, which is an...
exception to the studies conducted in the past by many authors (Sabiston and Gold and Chow et al.). The study revealed, less number of isolates per specimen which correlates with previous studies conducted by Hunt et al. 

In the study 77.14% patients were found to be having mixed microbial flora which is consistent with most of the studies.[2,6-8]

The percentage of isolation of anaerobic bacteria (49%) was less in our study compared to studies done by Sabiston and Gold[3] and Chow et al.,[4] but it is similar to the study conducted by Hunt and coworkers[5] and Aderhold and coworkers.[9] The anaerobic flora isolated was predominantly of anaerobic Streptococci (49%). Most of the earlier studies by Labriola et al.[6], Rega et al.[7], Gill and Scully,[8] and Yuvaraj et al.,[2] mentioned about mixed anaerobic flora in abscesses of orofacial region.

Staphylococcus species were isolated in 31% cases. The frequent isolation of Staphylococci in pus samples from odontogenic infections were confirmed by some previous studies (Sims[10]). The presence of *Staphylococcus aureus* in the study has clinical significance, since it develops resistance to many known antibiotics.

The isolation of Pseudomonas (6%) is high, when compared to other studies (Labriola et al.,[6] and Kariyama et al.,[7]). Pseudomonas becomes dominant and pathogenic when more susceptible bacteria of the normal flora are suppressed.[11] The injudicious use of antibiotics in dentistry may be the reason for isolation of more percentage of drug resistant pathogen[1] like Pseudomonas.

The incidence of other gram negative bacilli like Klebsiella in this study similar to earlier study reports,[1,12] Chow and associates,[4] Sabiston and Gold,[3] and Sims[10] were able to culture gram-negative bacilli up to a proportion of 4%. According to Walton,[13] gram-negative bacilli isolated in orofacial infections are likely key players in synergism with other bacterial species.

**Conclusion**

The microbiology of acute dental infections has been in the midst of many researches. The reported microbiology of odontogenic infections was for long time inconsistent, but a major role of anaerobes has become apparent with development of improved microbial isolation and culture techniques. The use of proper broth as carrier and culture media is necessary for identification of microorganisms. It is evident that orofacial odontogenic infections are polymicrobial, consisting both anaerobes and aerobes; as about 49% of species isolates were obligate anaerobes. Knowledge of the potential spectrum of pathogens, as well as regional resistance status is important for rational chemotherapy.

Though the sample size of this study is comparatively small, we can safely state that the microbiological flora of odontogenic abscesses consist of complex mixture of aerobic and anaerobic bacteria. This knowledge can guide us to use proper empirical antibiotics at the onset of odontogenic infection. The antibiotic sensitivity should be carried out in severe odontogenic infections for proper further management.

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