Volume 04, Issue 05 (September-October 2021), PP 09-16 www.ijmsdr.org
ISSN: 2581-902X

International Journal of Medical Science and Dental Research

Efficacy of empiric antibiotic therapy-An institutional based study.

P.G. Antony[a], Annapoorani D[b], Aneesh Sebastian[c], John Roshan T[d.]

[a]*Professor, Dept. of Oral and Maxillofacial Surgery, Government Dental College, Kottayam, Kerala India*

[b]*Senior Lecturer, Dept. of Oral and Maxillofacial Surgery, Adhiparashakthi Dental College and hospital, Tamilnadu.*

[c]*Reader,Dept. of Oral and Maxill ofacial Surgery, PMS Dental College,Trivandrum, Kerala University of Health Science, Kerala, India.*

[d]*Associate Professor, Department of Periodontics and Oral Implantology, PMS Dental College, Trivandrum, Kerala University of Health Science, Kerala, India.*

ABSTRACT: *Most purulent orofacial infections are of odontogenic origin. Empiric antibiotics were administered before the culture and sensitivity test results were obtained and specific antibiotics were administered based on the culture and sensitivity test results. But resistance was a challenging problem all throughout along with development of more virulent strains of microorganisms which were more infectious and resistant to many known antibiotics.*

Objective*: To identify the causative micro-organisms responsible for orofacial infections and to evaluate the resistance against empirical antibiotics used in the treatment of space infections.*

Method*: 142 patients with head and neck fascial space infections of odontogenic origin were randomly taken; the pus samples and aspirates were collected aseptically from patients for microbiological study.*

Results: *In this study the most common aerobic organism isolated was streptococcus viridians (34.49%), Amoxicillin was the most commonly used empirical drug in all cases and showed highest resistance (96.55%) for all the organisms. But linezolid (100%) was sensitive to all the organisms. Clindamycin (100%) appeared sensitive to the entire aerobic group.*

Conclusion: *Knowledge about the pathologic flora involved in head and neck infection in a locality and their sensitivity and resistance to commonly used antibiotics will help the clinician in administering appropriate antibiotics.*

I. Introduction

Head and neck space infections are mostly of odontogenic origin[1,2]. The role of bacteria in this was not discovered until the commencement of 20th century[1]. Odontogenic infection varies from periapical abscesses to superficial space and deep neck infection. In addition to systemic toxicity, it also causes advanced complications such as suppurative mediastinal spread, an airway obstruction, mediastinal involvement, pericarditis, arterial erosion, meningitis and extracranial or intracranial extension of infection.[3,4]

It is well established that odontogenic infections are not caused by a single organism; instead they are polymicrobial in nature[1,5–10]. These infections consists of various facultative anaerobes, such as the Streptococci viridans group, the Streptococcus anginosus group, and strict anaerobes, especially anaerobic cocci, such as Peptostreptococci, Prevotella,Fusobacterium species and Bacteroides[1]. Empiric antibiotics were prescribed before the culture and sensitivity tests results were obtained and specific antibiotics were selected based on the culture and sensitivity test results.

Resistance can either be inherent or acquired by the processes of genetic mutation or gene transfer[11]. The molecular biology of the antibiotic resistance can be mainly of the following four ways[11–13]. (1) Alteration of drugs target site. (2) Inability of the drugs to reach its target. (3) Inactivation of the antimicrobial agents. (4) Active efflux of antibiotics from the cell[11–13]. To cope up with the penicillin resistance, synthetic antibiotics were synthesized; however resistance was developed to these newer synthetic drugs also.13 The treatment of odontogenic infection is based upon three fundamental elements. (1) Recognition of airway compromise. (2) Surgical intervention, (3) Administration of specific antibiotic[14].

Culture analysis remains the backbone of clinical practice and the findings of a number of prospective and retrospective studies that give a valuable insight of the bacteria which are often the cause[1]. Microorganisms involved in infections can multiply very rapidly and bacteria can also freely exchange genes by conjugation, transformation and transduction between widely divergent species[11,12]. Indiscriminate use of antibiotics led to the development of more virulent strains of microorganisms which were more infectious and resistant to many antibiotics, hence making the treatment modalities tough.

The aims of the study was to qualitatively evaluate different aerobic flora with their antibiotic sensitivity in head and neck space infections of odontogenic origin and also to understand the efficacy of currently used empirical antibiotics in the management of odontogenic infections. Objectives of the study are to identify the causative micro- organisms responsible for head and neck facial space infections and to evaluate the resistance against empirical antibiotics used in the treatment of space infections.

B-Lactam antibiotics are widely recommended for empiric therapy with antibiotics against infections and we have elucidated the effectiveness of b-lactam antibiotics as first-line agents for treatment of these infections.

II. Materials and methods

Around 142 patients with head and neck fascial space infections of odontogenic origin were randomly taken for the study who attended the outpatient clinic of the Oral and Maxillofacial Surgical Department at the Government Dental College kottayam from September 2013 to September 2016. This includes males and females within an age group of 5 to 73 years. Pus samples and aspirates were collected aseptically from patients for aerobic and anaerobic microbiological study. Proper medical, dental and surgical history, clinical signs and symptoms were recorded and relevant investigations were done. All the patients were informed and explained about the details of the study and consent forms were signed from each patient.

Inclusion criteria

❖ Patients with head and neck fascial space infections of odontogenic origin.

❖ Patient who had not taken antibiotics for head and neck fascial space infections of odontogenic origin.

Exclusion criteria

❖ Patients who have taken antibiotics randomly for head and neck fascial space infections of odontogenic origin.

❖ Patients not willing to participate in the study.

❖ Patients with head and neck fascial space infections other than that of odontogenic origin.

❖ Patients with negative culture and sensitivity results.

Procedure

Aerobic culture

The site was anesthetized depending on the condition; pus samples were collected both intra and extra orally by transport cotton swab stick (Fig. 1) directly from the site and inoculated into the media plates; nutrient agar medium, blood agar medium and macConkey agar medium. Then these plates were immediately incubated at 37 °C for 24–48 h and were kept ready for observation of colonies (Fig. 2) and further gram staining, biochemical and antibiogram tests.

The grown colonies of organisms were spread over the Mueller hinton agar media plate and labelled antibiotic discs were placed. This plate was again incubated for 12–24 h at 37 °C. A zone of inhibition (Fig. 3) appeared surrounding the antibiotic disc indicating the sensitivity of organism to the particular antibiotic and was measured by the help of WHO quality control chart to assess the sensitivity. Clinical signs and symptoms were recorded frequently to assess the dissolution of infection.

Statistical analysis

The data was analyzed by student t-test and chi square test for statistical significance within group and between groups. For the analysis SPSS (16.0 version) was used. All the data has been represented as frequencies and proportions. The data was evaluated using chi square test. P value < 0.05 considered as statistically significant.

III. Results

Out of 142 patients; 58 samples were sterile and 84 cases were taken up for the study, 84Aerobic organisms were isolated and P < 0.05 significant.Out of 84 aerobic organisms 49 (34.49%) were Streptococcus viridians and was the most common organism isolated followed by 18 (20.69%) Staphylococcus aureus, 10 (17.25%) coagulase negative Staphylococcus, 4 (13.79%) Pseudomonas aeruginosa and both Escherichia coli and Klebsiella pneumonia were isolated from 3 (6.89%) specimens each. P < 0.05 significant compared Streptococcus viridians with other organisms.(TABLE-1). Among the pencillin group 83 (96.55%) out of 84 aerobic organisms were resistance to Amoxicillin, followed by ampicillin, cloxacillin, pencillin, augmentin (amoxicillin with clavulenic acid). Among the miscellaneous group of drugs, all the aerobic organisms were sensitive to linezolid (100%). Entire aerobic group were sensitive (100%) to clindamycin, Vancomycin and bacitracin turned out to be highly resistant and least sensitive. Furoxone, nitrofurantoin, septran, sporidex showed highest resistantance. P < 0.05 significant compared linezolid with other drugs in the group.

IV. Discussion

According to the literature, submandibular space is the most common site involved in multiple space infection followed by lateral pharyngeal, buccal and submental spaces.[7,15]. This was supported by Opeyemi O. Daramola and Poeschl PW.[15,16]. In the present study of 84 cases, we also found submandibular space (20%) to be the most commonly involved site in multiple space infection. In our study vestibular space 46 (36.8%) showed more predisposition, deviating from literature by A.J Raga et al[6]. who said that the submandibular space was the most common location for a single-space abscess (30%). Out of 84 cases, 46 (36.8%) cases were vestibular space followed by 24 (20%) submandibular, 16 (12.8%) buccal, 10 (10%) canine, 8 (6.4%) submassetric, 6 (4.8%) canine and buccal, 5 (4%) sublingual, 4 (3.2%) palatal space, temporal and ludwigs were affected in 3 (2.4%) cases each. From the above study, vestibular space turned out to be the most common site of infection followed by submandibular space.

In our study out of 84 aerobic organisms 49 (34.49%) were Streptococcus viridians and was the most common organism isolated followed by 18 (20.69%) Staphylococcus aureus, 10 (17.25%) coagulase negative Staphylococcus, 4 (13.79%) Pseudomonas aeruginosa and both Escherichia coli and Klebsiella pneumonia were isolated from 3 (6.89%) specimens each.

According to the literature it has been found that Streptococus viridianswas the most common pathogen in the head and neck space infections[1,6,13,17].This study also proves the same. The second mostcommon microorganism isolated was the Staphylococcus aureus [5](17.25%). These results were also supported by the previous studies[18].The third most common micro organism isolated in this study wasCoagulase negative Staphylococcus 4 (13.79%) which was found an importantsource of nosocomial infections. In this study, we found significantlevel of resistance to commonly used antibiotics in (6%)Coagulase negative Staphylococci.Penicillin has been the antibiotic of choice for most odontogenicinfections[8–10,20].But resistant organisms have developed due to its longand widespread use.[19,20]

In our institution Amoxicillin is the most common empirical antibiotic prescribed to patients with odontogenic infections. And in our study among the pencillin group, there was resistance to amoxicillin in 83 (98.55%) out of 84 aerobic organisms, followed by ampicillin, cloxacillin, pencillin, augmentin (amoxicillin with clavulenic acid). Among the fluroqunolones, organisms showed highest sensitivity towards ofloxacin and levofloxacin. Sensitivity to ofloxacin was seen in 72 (85.64%) out of 84 aerobic organisms, Resistance to ofloxacin was 12 (14.36%) out of 84 aerobic organisms, This result was supported by Munish Kohli[20]et al. in 2009. In his study ofloxacin was the most sensitive drug. The most resistant drugs were amoxicillin and ampicillin. The gram negative colonies were sensitive to cefotaxime.

In the present study, among aminoglycosides 13 (17.24%) out of 84 aerobic organisms, were sensitive to gentamycin. Resistance to gentamycin was noted in 71 (82.76%) out of84 aerobes, Streptomycin showed least sensitivity and highest resistance.

In the macrolide group, organisms were least sensitive to Erythromycin (3.45%) and showed higher resistance (96.67%). But sensitivity to azitromycin was17 (20.69%) out of 84 aerobic organisms, this high resistance to macrolides was supported by Paul. W. Poeschl[21]et al in 2010. He concluded that the high resistance rate for macrolides was striking and may necessitate an adoption of newer antibiotic regime in the future.

Among cephalosporins group, sensitivity to cefixime was58 (68.97%) out of 84 aerobic organisms, Resistance to cefixime was 26 (31.03%). Sensitivity to cefotaxime was 49 (62.07%) and resistance to cefotaxime was 36 (37.93%).

Among the miscellaneous group of drugs (Fig. 6), all the aerobic organisms were sensitive to linezolid (100%).

Vejayan Krishnan,[4] in 1993 described that pencillin resistant organisms have developed due to its long and widespread use so that clindamycin became preferred antibiotic for empiric therapy in his study. In literature, lots of reports about the resistance of amoxicillin and hence alternative antibiotic replacement have been reported such as clindamycin[5,15]. Even clindamycin failure with penicillin therapy and a rate of penicillin resistance also has been reported.

V. Conclusion

Specificity of empirical antibiotic therapy could be improved with good knowledge about the pathologic flora in the locality. There should be substitution of miscellaneous group of antibiotics such as linezolid, clindamycin, third generation cephalosporins such as cefixime, cefotaxime, and fluroqunolones such as ofloxacin and levofloxacin for amoxicillin in the empirical management of odontogenic space infections.

It can be concluded that the knowledge about the pathologic flora involved in head and neck infection in a locality and their sensitivity and resistance to commonly used antibiotics will help the clinician in administering appropriate antibiotics at the earliest phase of infection, which will adequately control the infection and hence minimize the morbidity rate.

Reference

[1.] Robertson D, Smith a. j. The microbiology of the acute dental abscess. J MedMicrobiol. 2009;58:155–162.

[2.] Kuriyama T, Karasawa T, Nakagawa K, et al. Bacteriology and antimicrobial susceptibility of gram positive cocci isolated from pus specimens of orofacial odontogenic infections. Oral Microbiol Immunol. 2002;17:132–135.

[3.] Chow AW, Roser SM, Brady FA. Orofacial odontogenic infections. Ann Intern Med.1978 March;88(3):392–402.

[4.] Krishnan VH, Jhonson JV. Management of maxillofacial infections. J Oral Maxillofac Surg. 1993;51:868–873.

[5.] Brook I, Fraizer EH, Gher ME. Aerobic and anaerobic microbiology of periapical abscess. Oral Microbiol Immunol. 1991;6:123–125.

[6.] Rega AJ, Aziz SR, Ziccardi VB. Microbiology and culture sensitivity test of head and neck space infection of odontogenic origin. J Oral Maxillofac Surg.2006;64:1377–1380.

[7.] Storoe W, Haug RH, Lillich TT. The changing face of odontogenic infections. J Oral Maxillofac Surg. 2001;59(7):739–748.

[8.] Lewis MAO, MacFarlane TW, McGowan DA. A microbiological and clinical review of acute dentoalveolar abscess. Br J Oral Maxillofac Surg. 1990;28:359–396.

[9.] Bridgemen A, Wiesenfeld D, Newland S. Major Maxillofacial infections.An evaluation of 107 cases. Aust Dent J. 1995;40:281–288.

[10.] Gill Y, Scully C. Orofacial odontogenic infection:Review of microbiology and current treatment. Oral Surg Oral Med Oral Pathol. 1990;70:155–158.

[11.] Barker KF. Antibiotic resistance: current perspective. Br J Clin Pharmacol. 1999;48:109–124.

[12.] Flynn TR, Halpern LR. Antibiotic selection in head and neck infections. Oral Max FacSurg Clin N Am. 2003;15:17–38.

[13.] Storoe W, Haug RH, Lillich TT. The changing face of odontogenic infections. J OralMaxillofac Surg. 2001;59(7):739–748.

[14.] Neu HC. The crisis in antibiotic resistance. Science. 1992;257:1064.

[15.] Daramola Opeyemi O, Flanagan Carrie E, Robert H. Maisel Diagnosis and treatment of deep neck space abscess. Otolaryngology-Head Neck Surg (Tokyo).2009;141:123–130.

[16.] Poeschl PW, Spusta L, Seemann R, Hirschl A, Poeschl E, et al. Antibiotic susceptibility and resistance of the odontogenic microbiological spectrum and its clinical impact on severe deep space head and neck infection. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2010;110:151–156.

[17.] Osborn Timothy M, Asssael LA. Deep neck infection:principles of surgical management. Oral Maxillofac Surg Clin. 2008;20:353–365.

[18.] Woods R. Pyogenic dental infection: a ten year review. Aust Dent J. 1978;23:107–111.

[19.] Abraham Ep, Chain E. An enzyme from bacteria able to destroy penicillin. Nature.1940;146:837.

[20.] Kohli Munish, et al. In vitro evaluation of microbiological flora of orofacial infections.J Maxillofac Oral Surg. 2009;8(4):329–333.

[21.] Poeschl PW, Spusta L, Seemann R, Hirschl A, Poeschl E, et al. Antibiotic susceptibility and resistance of the odontogenic microbiological spectrum and its clinical impact on severe deep space head and neck infection. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2010;110:151–156.

S. No.	**Aerobic Organisms**	**Frequency**	**Percentage (%)**
1	Streptococcus Viridans	49	34.49
2	Staphylococcus Aureus	18	20.69
3	Coagulase negative staphylococcus	10	17.25
4	Pseudomonas Aeroginosa	4	13.79
5	E. Coil	3	6.89
6	Klebsiella Pneumonia	3	6.89
	TOTAL	**84**	**100**

Table-1 Aerobic organisms.

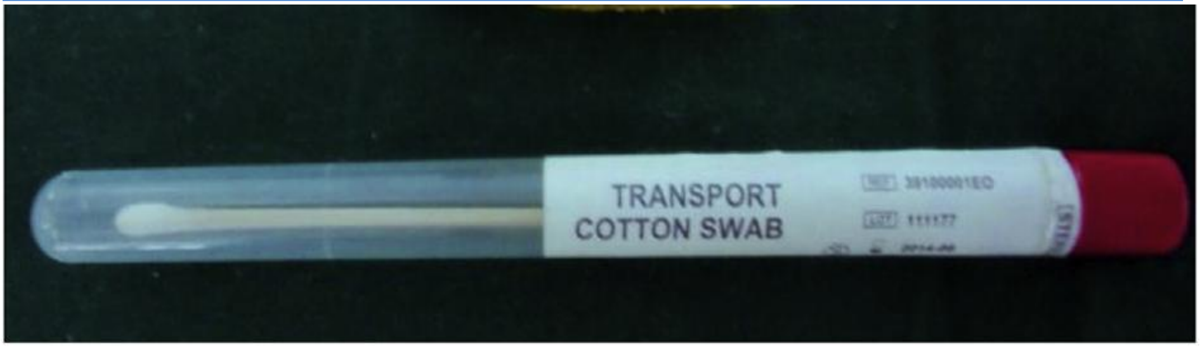

Fig. 1. Transport medium - Transport cotton swab.

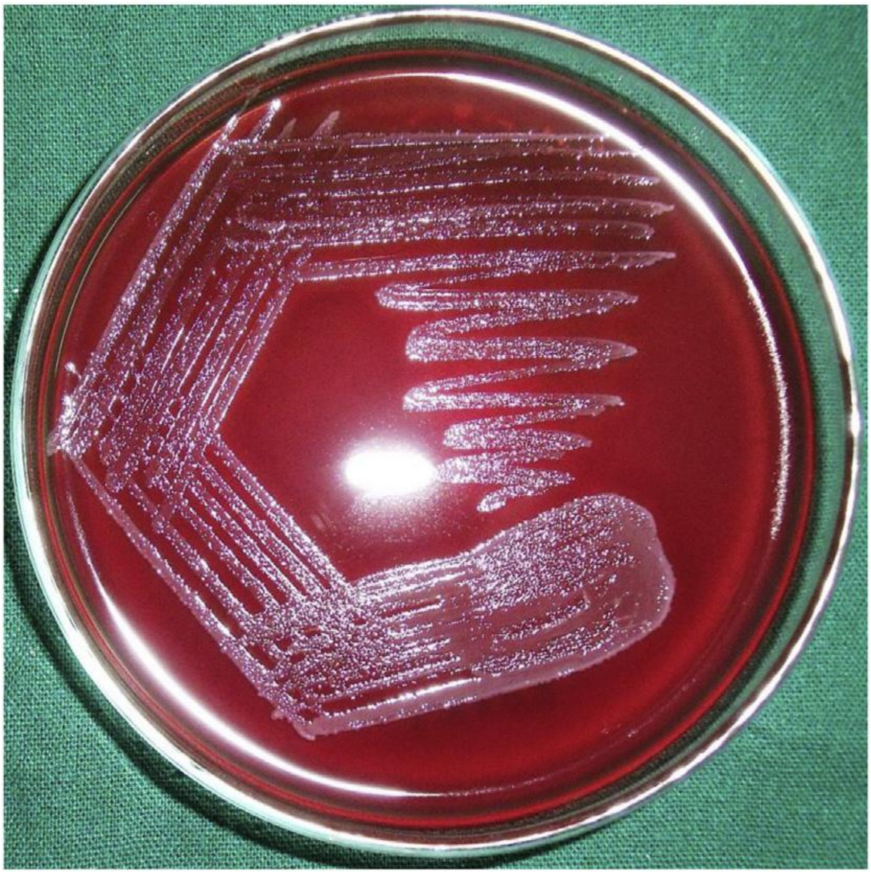

Fig. 2. Streptococcus viridians.

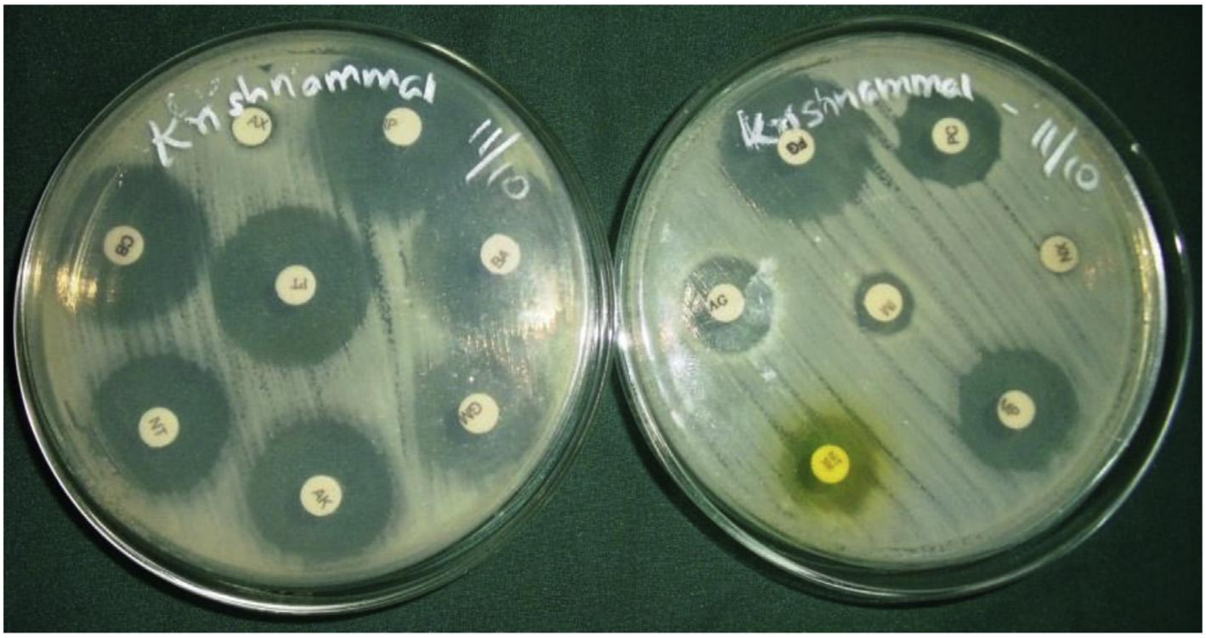

Fig. 3. Mueller hinton agar plate with antimicrobial disc showing antibiotic sensitivity.