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Odontogenic Infections: Etiology and Management

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ABSTRACT

Background: Odontogenic infection is a common problem facing the dentist and maxillofacial surgeon in their daily practice.
Objectives: To determine the involved fascial spaces, the pathogenic bacteria and their antibiotic sensitivity in order to guide clinicians in proper management of odontogenic infections.
Materials and methods: Pus samples were obtained from patients with odontogenic infections by needle aspiration or sterile swab at the time of abscess drainage. The samples were cultured aerobically and anaerobically conditions, followed by identification of bacteria using different biochemical tests and sensitivity test by disk diffusion method.
Results: This study included (20) patients, (11) patients were male and (9) female. The submandibular space was the most commonly involved. A mixed facultative anaerobic and strict anaerobic growth was observed in the cultures. Viridans streptococci was the predominant bacteria (42.42%), while the least isolated bacteria was *Fusobacterium spp* (9.1%). The isolated bacteria were highly susceptible to azithromycin (87.87%) and least susceptible to amoxicillin (39.39%).
Conclusion: Incision and drainage of involved fascial space with the removal of causative tooth and the use of appropriate antibiotic remain the ideal treatment option for odontogenic infection.

Keywords: Odontogenic infections, Orofacial spaces, Bacterial culture, Antibiotic sensitivity.

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INTRODUCTION

Odontogenic infections are one of the common problems that oral and maxillofacial surgeons deal with. Odontogenic infections of head and neck initiated in the teeth by a variety of disease processes [1]. Most orofacial Odontogenic infections arise from necrotic pulps, infected periodontal pockets, or pericoronitis of partially erupted teeth [1–3]. The lower teeth are the most common source of severe odontogenic infections than the upper teeth, with the mandibular third molar as the origin in a majority of cases [1, 3]. Odontogenic infections proceed through three stages: inoculation, cellulitis and abscess [4]. They varied from periapical abscesses to superficial infection in the neck and to deep infections [5, 6]. Bacteria enter the surrounding fascial spaces by direct extension from the periapical region of the involved tooth. The pattern of spread is predictable depending on the relationship between the point of attachment of the adjacent muscle and the tooth apex [7]. Following the path of least resistance through connective tissue and along fascial planes, infection may diffuse quite distantly from its dental source, causing damage to the surrounding structures [8]. The spread of infection into adjacent fascial spaces (submandibular, sublingual, masseteric, buccal, canine and parapharyngeal) may lead to additional complication [6]. An important feature of suppurative odontogenic infections is that they are typically polymicrobial in nature, with mixed aerobic and anaerobic bacteria present. However, the anaerobes generally outnumber aerobes by a factor of two to four folds [9]. Recent clinical studies have emphasized the importance of anaerobic bacteria in orofacial infections [10].

Bacteria produce pathogenicity through several mechanisms, including enzymes, metabolites and toxins, capsules that prevent phagocytosis and facilitate abscess formation,

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tolerance to air, and synergism with other bacteria [3, 11]. Early recognition and management of orofacial infections is mandatory.(9) The treatment of odontogenic infections is based on 2 fundamental elements: mechanical-surgical management and antibiotic therapy [8, 12]. The majority of these infections is self limiting and may drain spontaneously. Due to the proximity of the central nervous system and respiratory passages, timely efforts are required to establish a patent airway, mechanical debridement, drainage and appropriate antimicrobial therapy [13, 14]. Surgical incision and drainage may obviate the use of antibiotics or may increase the effectiveness of the antibiotics as the vascular flow is restored [15]. Antibiotics used should be active against both aerobic and anaerobic bacteria [16]. Furthermore antibiotic prescription is empirical and based on the clinical condition of the patient in some individuals. As a result, bacterial resistance developed leads to inappropriate treatment [17]. Therapy failure may occur if the pathogens involved are resistant to the drug of choice. Antimicrobial susceptibility testing is performed to guide the clinician in decision making [18].

The aims of this study are to determine the involved fascial spaces, the pathogenic bacteria and their antibiotic sensitivity in order to guide clinicians in proper management of odontogenic infections.

MATERIALS AND METHODS

This study was conducted at Al-Yarmouk Teaching Hospital, Department of Oral and Maxillofacial surgery during the period from January to July 2016. A total of twenty patients suffering from facial swelling were included in this prospective study. The College of Medicine, University of Anbar gave the approval of the present study and an informed consent was taken from every subject. After history taking and careful clinical examination of the patient and investigations, those patients were diagnosed to have an odontogenic infection. Management of these patients by incision and drainage of involved fascial space together with extraction of causative tooth and prescription of antibiotics intravenous augmentin (amoxicillin/clavulanic acid 1.2 g 8 hourly) and intravenous metronidazole (500 mg 8 hourly). For children the doses were calculated according to weight of the patient. Pus samples collected either by direct aspiration with 5 ml syringe before abscess drainage or by sterile swab from the depth of wound after incision and drainage.

The pus sample was spread on blood agar plate and on MacConkey agar plate. After that, some of the plates were incubated under aerobic conditions at 37^{o}C for 24 hours, and the other plates were incubated in an anaerobic jar at 37^{o}C for 48 hours. Aerotolerance testing was used. The isolated bacteria were identified by observing colony characters; morphology was confirmed with gram staining [19]. The identification of the organism was done by using different biochemical tests including API strips. Antimicrobial susceptibility was done on Mueller-Hinton agar using the disc diffusion method [20].

RESULTS

Among 20 patients, (11) were male (55%) and (9) were female (45%), with their age ranging from (5−60) years (Table 1). The most common causative tooth in this study was a mandibular third molar (35%) followed by mandibular first molar (30%), while the least common offending teeth were mandibular deciduous first molar and maxillary lateral incisor (5%) for each (Table 2). The submandibular space was most commonly involved (45%) followed by a buccal space (25%) (Table 3). A total of (33) bacterial isolates obtained from 20 patients. Viridans Streptococci (42.42%) are prominent among isolated bacteria, followed by *Prevotella spp* (27.27%) (Table 4). The gram-positive cocci (63.63%) are predominant isolated bacteria, while gram-negative bacilli account for (36.36%) of isolated bacteria in this study (Figure 1). The bacterial susceptibility to antibiotic in this study are shown in Table 5. The bacterial susceptibility and resistance to antibiotic in this study are shown in figure 2.

Table 1. Distribution of Patients with Different Age Groups.

Age	Number of patients	(%)
1−20	3	15
21−40	13	65
41−60	4	20

Table 2. Offending teeth in the Odontogenic infections in patients.

Causative Teeth	Cases	(%)
Mandible		
Mandibular third molar	7	35
Mandibular second molar	3	15
Mandibular first molar	6	30
Mandibular deciduous first molar	1	5
Maxilla		
Maxillary Canine	2	10
Maxillary Lateral incisor	1	5
Total	20	100

Table 3. Site distribution of Orofacial Space Infection.

Fascial Space	Number of patients	(%)
Submandibular space	9	45
Buccal space	5	25
Submassetric space	2	10
Canine space	3	15
Palatal space	1	5
Total	20	100

Table 4. Bacteria isolates from patients with Odontogenic infections.

Organism	Number of isolates	(%)
Viridans Streptococci*	14	42.42
Peptostreptococcus spp	7	21.21
Prevotella spp	9	27.27
Fusobacterium spp	3	9.1

* *Streptococcus mutans* (n=6), *Streptococcus mitis* (n=8)

DISCUSSION

Most acute orofacial infections are odontogenic in origin [2], in which microflora of the oral cavity are the causative agents when they enter normally sterile tissues [6] and in the presence of predisposing factors like increased age and decreased patient immunity [13]. The anaerobic bacteria of the oral cavity

Table 5. Distribution of antibiotic sensitivity according to bacterial strains.

Organism	Amoxicillin	Amoxicillin/ clavulanic acid	Metronidazole	Clindamycin	Azithromycin	Doxycycline
Viridans Streptococci	5(35.71%)	8(57.14%)	4(28.57%)	10(71.42%)	12(85.71%)	9(64.28%)
Peptostreptococcus spp	4(57.14%)	5(71.42%)	6(85.71%)	6(85.71%)	6(85.71%)	6(85.71%)
Prevotella spp	3(33.33%)	6(66.66%)	7(77.77%)	6(66.66%)	8(88.88%)	7(77.77%)
Fusobacterium spp	1(33.33%)	2(66.66%)	2(66.66%)	3(100%)	3(100%)	2(66.66%)

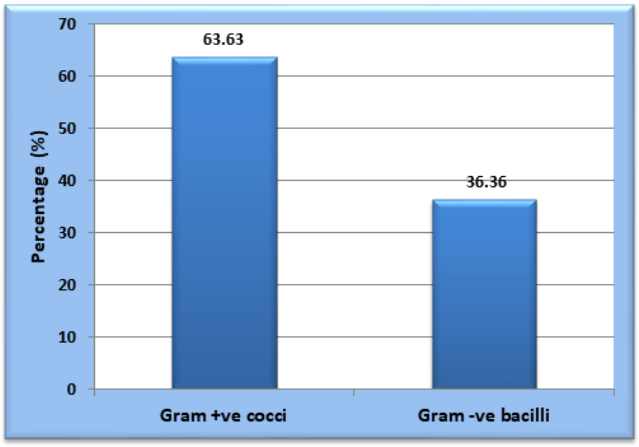

Figure 1. Distribution of isolated bacteria in the study.

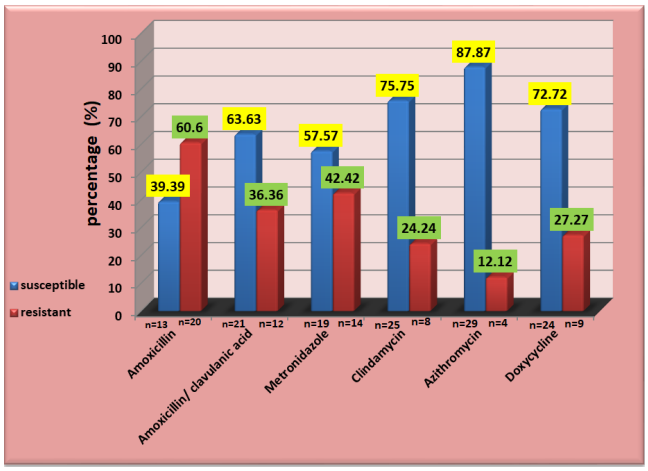

Figure 2. Susceptibility and resistance patterns of antibiotics.

which outnumber aerobic bacteria, therefore most of studies find the prevalence of anaerobic bacteria to be higher in odontogenic infections [21]. Early diagnosis and management of odontogenic infection is necessary to prevent the potential complication from infection spread to adjacent tissue [22].

In present study, the male gender account for (55%) of the patients with male to female ratio (1.2:1). Similar gender distribution of patient with odontogenic infections was found in other studies [6, 12] the age group most commonly involved was (21−40) year (65%) this finding was similar to another study [23]. There are no studies that show if age has an impact on incidence fascial space infections [24].

The findings of the study are consistent with other studies where submandibular space is the most predominant, followed by the buccal space abscesses [15, 24] and disagreement other study that show the buccal space was most commonly involved followed by submandibular and canine space [23]. This was attributed to the spreading of infection is depending on the position of roots in relation to the muscle attachment (mylohyoid, buccinators) and the thin lingual cortical plate in mandible and thin buccal cortical plate in maxilla through which the infection spread [24]. The isolated bacteria in the current study consisted of mixed facultative anaerobic and strict anaerobic bacteria. This result is in accordance with other studies [12]. This finding may be due to the fact that odontogenic infection is caused by the interdependence and synergism in the metabolism of a variety of microorganisms, so that the metabolism and respiration of aerobic bacteria depletes oxygen and provide a suitable environment for anaerobic growth [13, 23].

In this study, the strict anaerobe bacteria outnumber facultative bacteria by a ratio of 1.4:1 which is close to the ratio of other studies which varies between 1.5−3:1 [25–27]. In the present study, the predominant isolate was Viridans Streptococci and it is in agreement with previous studies [6, 15, 28].

The study revealed most of isolated bacteria were sensitive to azithromycin (87.87%) which in accordance to another study where the susceptibility to azithromycin was (90%)[6]. The least sensitivity reported in our study was to Amoxicillin (39.39%) this result in accordance to another study [18], because abuse of amoxicillin by patients that lead to appearance of bacterial strains resistant to this antibiotic.

In conclusion, incision and drainage of involved fascial space with the removal of causative tooth and the use of appropriate antibiotic remain the ideal treatment option for Odontogenic infection.

CONFLICT OF INTEREST

The authors declare there is no conflict of interest.

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