

Bacterial Microbiology and Antibiotic Sensitivity in Maxillo-mandibular Infections

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Abstract

Oral cavity is important functional structure of the body, like other parts of the body it contains micro bacteria as a commensally structures. Several species of bacteria present in the mouth that exploit the circumstances of human immunity and oral hygiene to cause infections which can spread to the facial region and neck to the rest of the body and lead to serious outcome.

Background: Determine most common bacterial microorganisms and antibiotic sensitivity of maxillomandibular infections.

Materials and Methods: A descriptive study was carried out on 45 patients with different forms of maxillomandibular infections, data regarding age, gender, presenting signs were collected through history, clinical examination and radiographs, incision and drainage with swab sample for culture and sensitivity test was done.

Results: Patients with maxillomandibular infections showed a male to female ratio of 1:1.25 The mean age was 33 years. Most of the patients were in the 4th decade 27% of life, most common isolated microorganism was *Streptococcus pyogenes* 59%, antibiotics with greatest sensitivity were Netilmicin, Cefoperazone and Rifampicin 91%.

Keywords

Maxillomandibular infections; Microbiological susceptibility; Sensitivity test

Introduction

Dental infection has plagued humankind for as long as our civilization presents. Bacteria that causes odontogenic infections are usually part of the commensal flora of the oral cavity, when bacteria get access to deeper tissues, they will cause odontogenic infections, in the state of sufficient pathogenic bacteria and a weak body condition, infections may spread to various spaces in the oral cavity [1,2]. Culture media is of fundamental importance for most microbiological tests: to obtain pure cultures, to grow and to count microbial cells, and to cultivate and select micro organisms, without high quality media then the possibility of achieving accurate, reproducible and repeatable microbiological test results is reduced. Culture media contains nutrients, growth promoting factors, energy sources, buffer salts, minerals, metals and gelling agents (for solid media) [3,4]. Different types of culture media are typically divided, based on the physical state of the media, into: a) Liquid culture media, commonly called 'broth'; b) Solid and semi-solid culture media, commonly called 'agar', these include growth media (designed to grow most heterotrophic microorganisms); transport media (for preserving microorganisms); enrichment media (media designed to increase the numbers of desired microorganisms) and selective growth media. The two common general medium types are nutrient agar or broth; and tryptone soya agar or broth. Tryptone soya broth, which is used for sterility testing and as a general growth broth, in microbial enumeration tests, as well as used for media simulation trials [5-7]. Where monitoring for fungi is required, such as part of an environmental monitoring regime, the commonly used media are sabouraud dextrose agar or malt extra agar; for the microbiological examination of water, R2A is used, this is a low nutrient agar used for the cultivation of heterotrophic microorganisms, other media are used for microbiological identification, such as Columbia blood agar (for the detection of haemolytic reactions by *Staphylococci*).

Dentists benefited greatly from discovery of penicillin because most of the orofacial infections are caused by penicillin-sensitive microorganisms, the microbiological environment has been polluted with bacteria that are resistant to many antibiotics, this alteration in antibiotic sensitivity is now the expected result of wide spread use of antibiotics. The risk of the individual patient from a single prescription of antibiotic is small, but altered bacterial flora represents a present and future risk to the community [8,9]. Traditionally, high-dose penicillin or clindamycin in patients with penicillin allergy have been used as first-line antibiotic choice, however, recent studies have indicated that 13% of *Streptococci viridans* (the most common isolate in head and neck infections)

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cases show resistance to penicillin. In addition, clindamycin has little efficacy if aerobic gram-negative bacteria are the causative pathogens. Poeschl et al. [10] reported 18% clindamycin resistance in aerobic bacteria and 11% resistance in anaerobic isolates in their review of deep space infections [10,11].

Materials and Method

This study included 45 patients who attended Oral and Maxillofacial Unit at Ghazi AL-Hariry Hospital in Medical City Baghdad. The patients complained from acute or chronic swelling that involved one or more of fascial spaces in the head and neck region. This swelling was associated with one or more of the following signs and symptoms: fever, redness of skin, tenderness, or limitation of mouth opening, the age of the patients ranged between 4-80 years, patients were 20 males and 25 females with different social and education levels. Fourteen patients were treated in maxillofacial consultation clinic and 31 admitted to the ward, 9 of them were treated under general anesthesia and 36 under local anesthesia. For every patient a standard case sheet was filled. This concentrated on demographic information, history, investigation, diagnosis, treatment, and postoperative follow up. Selection of the patients for this study was done irrespective of the cause of infection, at admission, demographic data, social and past medical histories were obtained. History taking was the prime object to select the patient for the study, thorough clinical examination was carried out which include extraoral comprise inspection and palpation of the swelling to detect site, size, the redness of skin, extension of the swelling and presence of breathing difficulties, sinus or discharge in the head, neck, and face. Palpation of the lymph nodes for any lymphadenopathy in the head and neck lymph nodes, and intraoral detailed examination of the oral cavity, dentition, oropharynx was done by using diagnostic set. Examination include inspection, palpation of the causative factor (exposed bone, exposed plate and sequester etc.), or the offending tooth if it is carious or fractured, percussion and vitality test for the tooth were done. Then radiographic request form was filled to obtain the radiographic view of offending region, with either intraoral film (periapical) and extraoral film (orthopantomography). Preoperative investigations included (hemoglobin level, blood sugar, blood urea, serum creatinine, blood pressure and chest X-ray). Consultation of other specialties were obtained when patients had systemic diseases likes (diabetes mellitus, chemo and radiotherapy, kidney disorders or transplantation, patient taking cortisone, hypertension, cardiac problem or bleeding disorder or when there was airway compromise due to infection and tracheostomy was deemed necessary to secure airway, consultation of the anesthetist was obtained when general anesthesia was considered necessary for treatment.

Intra operative management-Surgical intervention

The surgical management was done under local or general anesthesia, all cases that have been diagnosed as an "abscess" were drained as a first line of treatment. In cases of odontogenic infection the intra-oral drainage included either tooth extraction or incision or both while the extra-oral drainage included incision and drainage with or without tooth extraction. After disinfecting the area of drainage by butadiene and toweling of patient, local anesthesia was administered only to incision point to skin or mucosa and not intra-lesional, the incision made by No. 15 scalpel perpendicular to the most fluctuant point through the skin or mucosa, at parallel to the skin creases or wrinkle lines or intra orally through oral mucosa in the buccal vestibule or labial vestibule. The location of the incision differed according to the involved fascial space, as the pus was drained culture stick swab was inserted through the incision deep to take a sample for culture and sensitivity test, for drainage of abscess, Hilton's method (named after John Hilton, a British surgeon, 1804-1878) was followed, this method entails the insertion of a closed sinus or artery forceps through the incision to the pus containing tissue space and opened inside the cavity then the forceps are drawn open then closed and reinserted, to a void damage to vital structures, these steps were repeated with the forceps guided to different directions to open all pus locules as in, irrigation of the cavity done through incision site by normal saline.

The pus samples were collected and sent to microbiology laboratory where specimens were inoculated in sterile broth agar and incubated at water bath at 37 degree centigrade. After dressing empirical antibiotic prescribed either parenteral as Ampiclox 500 mg every 6 hours for adult or 250 mg for children above 2 years, 125 mg for patients under 2 years. In cases of allergy to penicillin Erythromycin was prescribed for adults and pediatric patients, the recommended intravenous dose of Erythromycin lactobionate is 15 to 20 mg/kg/day every 6 hours. For full coverage of anaerobic bacteria Metronidazol (flagyl) 7.5 mg/kg infused over one hour every 6 hours (approximately 500 mg for a 70-kg adult) was prescribed. Analgesics also were given as parental Acetaminophen (paracetamol) 500 mg for adult, 15 mg/kg for children every 8 hours. Or oral antibiotic for adult Augmentin (Amoxicillin with Clavulanic acid) tablet 625 mg for children (Amoxicillin with Clavulanic acid) syrup 312 mg every 8 hours, in cases of allergy to Penicillin, Erythromycin tablet 500 mg every 6 hours, Erythromycin syrup 125 mg/ 5 ml for children, every 6 hours. Metronidazol (Flagyl) tablet 500 mg every 8 hours for adult or Metronidazol syrup 200 mg-5 ml for children under 12 years, Analgesia Acetaminophen (paracetamol) 500 mg tablet every 8 hours for adult, and Acetaminophen (antipyrol) syrup 160 mg 1 teaspoon every 8 hours for children. After the results of sensitivity test appeared the antibiotic was changed according to the sensitivity test, and given for 5 days (Figure 1).

Statistical analysis

Statistical analysis included descriptive statistics for the collected data in addition to Chi-square test to determine the significance of difference among different groups; the level of significance was set at $p < 0.05$.

Results

A total of 45 patients were recruited in the study. Females having maxillomandibular infections comprised 56% (25) while 44% (20) of the sample were males, with a male to female ratio of 1:1.25. The difference between females and males was statistically not significant at $p \leq 0.05$ (X2 Value is 0.556. The p Value is 0.456). The age of patients ranged from 4 to 80 years with the mean age of 33 years. The frequency of maxillomandibular infections was the highest in the

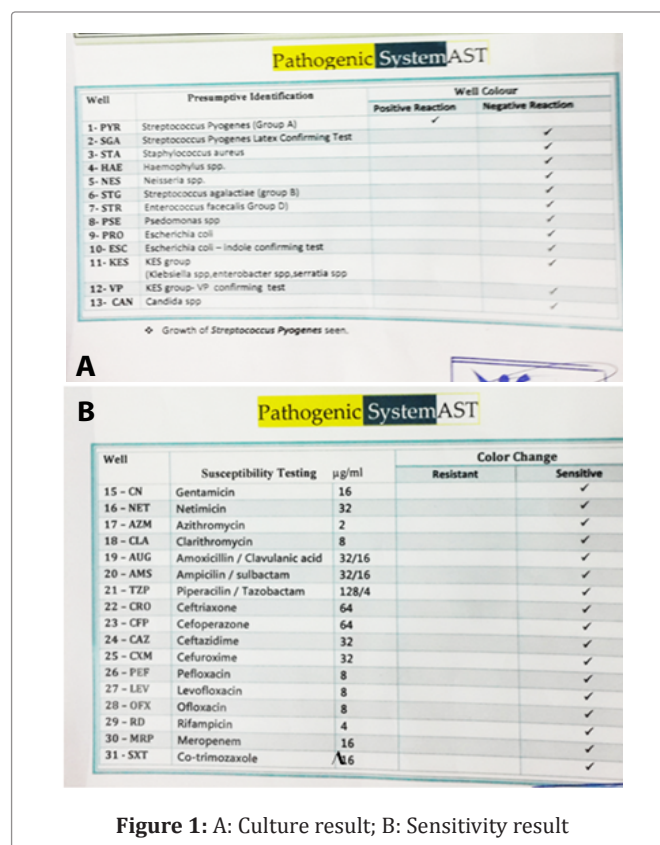


Figure 1: A: Culture result; B: Sensitivity result

4th decade 27% followed by 3rd decade 24% and 5th decade 15.55% and 2nd decades 15% equally respectively.

This study shows the pain degree associated with the infection through the period of 2 weeks, follow up interval at (24 hrs, 72 hrs, 1 week, 2 weeks), at 24 hrs the pain degree is 6, the greatest percentage

	Microorganism	Number of occurrences	%
1	<i>Klebsiella</i> spp.	5	9.8
2	<i>Streptococcus pyogen</i>	30	58.82
3	Negative coagulate <i>Staphylococcus</i> spp.	3	5.88
4	<i>Proteus</i> spp.	3	5.88
5	<i>Pseudomonous</i> spp.	1	1.96
6	<i>Haemophylus</i> spp.	4	7.84
7	<i>E. coli</i>	1	1.96
8	<i>Enterococcus facalis</i>	4	7.84
	Total	51	100

Table 1: Distribution of isolated microorganism

Antibiotics	Resistance	%	Sensitivity	%
Gentamicin	15	33.33	30	66.66
Netilmicin	4	8.88	41	91.11
Azithromycin	12	26.66	33	73.33
Clarithromycin	11	24.44	34	75.55
Amoxicillin/Clavulanic	13	28.88	32	71.11
Ampicilin/Sulbactam	9	20	36	80
Piperacilin/Tazobactam	6	13.33	39	86.66
Ceftriaxone	12	26.66	33	73.33
Cefoperazone	4	8.88	41	91.11
Ceftazidime	21	23.33	24	46.66
Cefuroxime	5	11.11	40	88.88
Pefloxacin	5	11.11	40	88.88
Levofloxacin	5	11.11	40	88.88
Ofloxacin	6	13.33	39	86.66
Rifampicin	4	8.88	41	91.11
Meropenem	12	26.66	33	73.33
Co-trimoxazole	15	33.33	30	66.66

Table 2: Sensitivity test

Pain (degree)	24 h	%	72 h	%	1 week	%	2 weeks	%
10	1	2.22	0	0	0	0	0	0**
8	14	31.11	5	11.11	2	4.44	1	2.22 ⁺
6	16	35.55	14	31.11	4	8.88	1	2.22**
4	12	26.66	10	22.22	14	31.11	7	15.55 ⁺
2	2	4.44	15	33.33	9	20	13	28.88 ⁺
0	0	0	1	2.22	16	35.55	23	51.11**

* $p < 0.05$: Significant; ** $p > 0.05$: Non significant

Table 3: Pain Scale

36% which is decreased gradually to reach 2%, while the degree 0 increased at 2 weeks to become the greatest percentage 51% (Tables 1-3).

Discussion

Odontogenic infections are among the conditions most commonly treated by oral and maxillofacial surgeons. These infections affect a large portion of the population, and can give rise to serious complications if not treated quickly and adequately. Thus, the importance of infections of dental origin is their high incidence and morbidity. The study shows that orofacial infections affect patients in their 3rd and 4th decade of life. This finding is similar to the earlier observation reported by Rashi Bahl et al. [12], who stated that the age of the patients ranged from 14 to 60 years. Individuals of odontogenic infections were seen more in the patients of the third and fourth decade age groups, in contrast to Richard Kityamuwesi et al. [9], who reported that in the present study, the mean age of the patients was 29.5 years which is lower than values recorded in other studies. Most patients (73.1%) were younger than 35 years. This may be due to the demographic differences between our study and this study. Our study revealed a higher frequency of the females than males 56% female to 44% male so the female to male ratio is about 1.25:1. However, the difference was not significant indicating that gender may not be considered as a determinant factor in the prevalence of orofacial infections and this accepted with R Sánchez et al. [13], who stated that the two genders were equally represented in our study, and Marina et al. [14], who stated that there was no significant gender difference for clinic visit rate due to orofacial infections in this study cohort (20), however Bruno Veronez et al. [15] reported that in this study, men were more affected (53.33%) and this may be due to men less care about their oral hygiene. In this study show that the most common microorganism associated with orofacial infections was *Streptococcus pyogen* (59%), which is gram positive aerobic bacteria, this agreed with recent studies of Celakovsky P et al. [16], who recorded that *Streptococcus pyogenes* was the most commonly isolated bacterium, also Min Kyoung Kim et al. [11], reported that most bacterial isolates in the present group were *Streptococcus* species (54%), and Poeschl et al. [10], due to *Streptococcus* is most common commensal oral flora, in our study *Klebsiella* (10%) was the second bacteria isolated this goes with Santosh et al. [1] found that the most common organisms isolated from aerobic bacteria were *Streptococcus viridians* 24 (36.4%), followed by *Klebsiella* 18 (27.3%), this is may be due to as the infection spread to secondary space or deep neck space, while this is contrast to Ingo Sobottka et al. [17] who reported that anaerobic bacteria were the most commonly isolated organism in odontogenic infections, this difference may be attributed to the method of obtaining the sample for culture and sensitivity test. In our study after *Streptococcus* spp. the *Enterococcus facalis* and *Haemophylus* come with (8%) and *Staphylococcus*, *proteus* (6%), finally *pseudomonas* spp. and *E. Coli* (2%).

In this study the antibiotics which had the greatest sensitivity and least resistance were (Netilmicin, Cefoperazone and Rifampicin), this in contrast to Bresca-Salinas M et al. [18], reported in their study that the common-use antibiotics with the greatest sensitivity and lowest resistance were shown to be amoxicillin/clavulanate followed by amoxicillin alone, and Nagendra S. Chunduri et al. [9], who mentioned that in our study, 90% of gram-positive cocci and 79% of gram-negative rods are susceptible to amoxicillin. Also according to Yuvaraj V et al. [19], some authors described the organisms causing infection as aerobes (68.2%), mixed (13.6%) and anaerobes (9.1%), and they state that according to their results the microflora-causing maxillofacial infection did not change, and penicillin remains the drug of choice in treating these infections. This finding is in contrast with ours where Amoxicillin/Clavulanic showed a relatively high resistance as compared to other antibiotics, this is possibly due to abuse of wide spectrum antibiotics that is prevalent leading to the emergence of resistant strains of micro-organisms. The use of an antibiotic with an unsuitable spectrum that does not act on certain resistant bacteria species will lead to excess propagation of the latter by eliminating other sensitive species, this may trigger acute exacerbations or persistent infection, the possibility that in interdependent, synergistic, mixed infections, as long as one bacterial species is sensitive to Penicillin, the entire

pathogenic complex may be rendered nonpathogenic, also in our study we found differences in the sensitivity and resistance between the generations of cephalosporines as cefoparazone shows high sensitivity (91%) which is third generation while cefuroxime (second generation) shows (89%) sensitivity this indicates the development of resistance of bacteria, on the other hand both of 3rd generation of cephalosporines ceftriaxone (73%) and ceftazidime (46%) show decrease in sensitivity and more resistance this can be attributed to widely abuse prescription of these two medications from medical staff in our country. In this study Metronidazole sensitivity was not done due to lack of Metronidazole discs in the Hospital laboratory. But Metronidazole is only effective against obligate anaerobes, because its molecule must enter the bacterial cell before it is reduced to form the active antibacterial agent and this reduction takes place effectively only under anaerobic conditions [20]. All patients had pain and swelling on presentation, which corroborates with A. Read-Fuller et al. [21], who reported that Rapidly-worsening swelling, dysphagia, pain, and trismus are the most common presenting symptoms.

The pain observed for all patients throughout the follow up period reveal that pain score at the first 24 h was degree 6 according to Wang Baker faces pain scale the most prominent (36%) as this study include patients with postoperative infections and most of them presented with history of mild to moderate pain and some of them had only burning sensation at the site of infection. After 72 h was degree 6 slightly decreased (31%), this is mostly due to that the females had high prevalence in this study than males as described earlier and pain varies from male to female which is higher in female because it influenced by hormonal changes occur in female during their life Roger B. Fillingim et al. [22] who concluded that the prevalence of most common forms of pain is higher among women than men, and women report greater pain after invasive procedures than men, that pain thresholds for mechanical, thermal, and ischemic muscle pain were higher during the follicular phase of the menstrual cycle, while pain score degree 2 was increased (33%) as the most of patient with post operative infections had slight pain or only burning sensation at the site of the operation or they had sinus discharge which decrease the degree of pain. Two weeks later the pain disappear completely as degree 0 from half of patients (51%).

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