ISOLATION AND IDENTIFICATION OF BACTERIAL SPECIES ASSOCIATED WITH ODONTOGENIC INFECTIONS

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ABSTRACT

Odontogenic infection is an infection that originates within a teeth and the closely surrounding tissues as the dental pulp, jawbones, periodontium, or in closely surrounding tissue. This study aimed to isolate and detect bacteria associated with odontogenic infections and identify antimicrobial susceptibility against predominant bacterial isolates.

A total of 30 pus samples were collected by aspiration and placed in transport media. “These pus samples subjected to different methods for identification of bacteria using traditional bacteriological method”. The antimicrobial liability of isolated bacteria was determined by using disc diffusion method.

Predominant isolated bacteria was Streptococcus viridans group (36%) followed by S. aureus (26.2%) and lowest percentage of isolated bacteria was black pigmented bacteria (Prevotella and Porphyromonas spp), in addition to K. Pneumonia and E. coli. The results showed very high susceptibility of isolates to amoxicillin (97%) followed by cefotaxime and imipenem (94%). Whereas the lowest sensitivity was detected to clindamycin (18%).

The present results approve the existence of mixed bacterial infection with the predominance of Streptococcus viridans. Most Streptococcus viridans were inhibited by amoxicillin followed by cefotaxime and imipenem.

Keywords: Odontogenic infection, Streptococcus viridans groups, Antibiotic susceptibility test


INTRODUCTION

Odontogenic infection is an infection that originates within a teeth and the closely surrounding tissues as the dental pulp, jawbones and periodontium; mostly bacterial in origin [¹]. Odontogenic abscess is polymicrobial composed of mixed bacteria, Streptococcus viridans groups were the predominant species in...
pus samples, moreover anaerobic bacteria in odontogenic abscess comprise mainly gram-positive cocci and gram-negative rods such as *Prevotella* spp., *Fusobacteria* and *Porphyromonas* spp. [2]. The mouth is the most multifaceted and the open contagious environment of the body. The teeth, gingivae, tongue and oral mucosa all offer diverse surface for infectious establishment [3]. The presence of nutrient, epithelial debris, saliva secretion make the mouth a favorable habitat for great variety of bacteria, odontogenic infection is caused by shift in the behavior and composition of plaque bacterial communities [4]. “Commonly antibiotic used in the treatment of odontogenic infections which have long possessions on microbiota and lowering the prevalence of commensal bacteria families” [5, 6]. The study by Bahl *et al.*, [7] revealed that modern antibiotic therapies have greatly reduced the complication from spread of these odontogenic infections, but certain pus in neck and head still require surgical management. Management of odontogenic infection included eight subsequent events which are the brutality of infection, evaluation of host defenses, setting of care decision, surgical treatment, medical support, choosing and prescribe antibiotic therapy, administer the antibiotic properly and evaluate the patient frequently [8]. So this study aimed to isolate and detect predominant bacteria associated with odontogenic infections and identification of antimicrobial susceptibility against predominant bacterial isolates.

**MATERIALS AND METHODS**

Study subjects consisted of 30 (17 males and 13 females range from 9-60 year old, mean 56±5.18). Pus samples taken by the swabs or pus aspirated from abscess using disposable syringe and the samples were immediately injected into thioglycolate broth for anaerobic culture and BHIB for aerobic culture then transport samples to the laboratory of oral microbiology for separation and discovery of studied bacteria. The bacteriological study including cultural properties, microscopic examination and biochemical tests was done according to MacFaddin *et al.*, [9], Forbes *et al.*, [10]. Al-Rawi [11]. “Statistical analysis castoff in this study includes calculation of mean values and percentage”.

**RESULTS**

The results of current study revealed that predominant bacterial isolates from odontogenic infections was *Streptococcus* viridans group (36%) followed by *Staphylococcus aureus* (26.2%) and lowest percentage of isolated bacteria was black pigmented bacteria (*Prevotella* and *Porphyromonas* spp), as well as *K. pneumonia* and *Escherichia coli*. The results shown in table (1).
Table 1: Number and Percentage of bacterial isolates from odontogenic infection.

<table>
<thead>
<tr>
<th>Bacteria Isolates</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Streptococcus viridans</em></td>
<td>22</td>
<td>36%</td>
</tr>
<tr>
<td><em>Staphylococcus aureus</em></td>
<td>16</td>
<td>26.2%</td>
</tr>
<tr>
<td><em>Lactobacilli spp</em></td>
<td>13</td>
<td>21.3%</td>
</tr>
<tr>
<td><em>Klebsiella pneumoniae</em></td>
<td>4</td>
<td>6.5%</td>
</tr>
<tr>
<td>Black pigmented bacteria</td>
<td>4</td>
<td>6.5%</td>
</tr>
<tr>
<td><em>E. coli</em></td>
<td>2</td>
<td>3.2%</td>
</tr>
<tr>
<td>Total</td>
<td>61</td>
<td>100%</td>
</tr>
</tbody>
</table>

The predominant *Streptococcus viridans* were subjected to antibiotic sensitivity test by modified Kirby- Bauer disc diffusion. Selective antibiotics are most commonly used in odontogenic infection to show their effect on viridans groups as shown in the figure (1).

The results showed high sensitivity of isolates to amoxicillin (97%) followed by cefotaxime and imipenem which were (94%) for both and (90%) of isolates were sensitive for ampicillin, then the sensitivity to metronidazole (85%)and erythromycin (80%), respectively. Also this study showed (69%) of sensitivity to azithromycin, followed by (66%)to tetracycline, While lower degree of sensitivity to doxycycline(36%),finally the results revealed very low degree of sensitivity to clindamycin (18%).
DISCUSSION

The results of present study included, aerobic, anaerobic and facultative anaerobes isolates, the predominant isolated microorganisms were *Streptococcus* viridians species, which represent 22 isolates (36%). This predominance of these bacteria may be due to its ability to cause dental caries which may be progress to pulp infection, dental bad hygienic measurements and end with odontogenic infection. This finding compatible with other studies that revealed predominance of *Streptococcus* viridians *spp* [3]. The second frequent isolated bacteria was *S. aureus* which was isolated from 16 case (26.2%). This frequency due to it may be enter the oral cavity from exogenous source as normal flora because it widely distributed in various environment which are associated with skin, skin gland and mucous membranes of human, as well as *S. aureus* strain was known to develop resistance to routine antibiotic therapy due to it has cell wall very thick in comparison with other gram- positive bacteria, as well as *S. aureus* strain was known to develop resistance to routine antibiotic therapy [24]. On other hand, *Lactobacilli spp.* were isolated from 13 cases representing (21.3%) of studied odontogenic infection, this finding in consistent with study of Sánchez *et al.* [21] who isolated Lactobacilli *spp.* from deep pulp infection secondary to *S. mutans*, although it cannot concluded that the bacteria is essential for the initiation of infection of vital pulp tissue, while the subsequent extension of infection is associated with development of a polymicrobial flora. Analysis of the spatial distribution of the organism does not support cooperation or dependencies between groups of bacteria, it is also note the high concentration of anaerobic bacteria are detected in regions of tissue that are clearly necrotic this indicate a favorable environment for growth of these bacteria rather pathogenic bacteria [18].

In addition, the present study reflected low percent isolation of black pigmented anaerobic bacteria (*Prevotella* and *Porphyromonas* spp) which were 4 only representing (6.5%) of the cases. This finding was in agreement with Chettiar *et al.* [6] who isolated these bacteria from odontogenic abscess, where they
represent natural members of the oral microbiota and become highly destructive and proliferate influenced by capacity to participate in oral biofilm formation. Moreover, the virulence potential of dark pigmented bacteria has ability to confront phagocytosis, degrade immunoglobulins and increase pathogenesis when combined with other strain of bacteria [7].

Furthermore, gram-negative aerobes were isolated from 6 patients (9.7 %). This percent represented by (6.5%) K. pneumoniae which was isolated from 4 cases and E. coli from two subject 2 constituted (3.2 %). These results were compatible with Rao et al., [20], Chang et al., [5], they stated that isolation of gram's negative bacilli like K. pneumoniae and E. coli from oral lesions at normal frequency, also they stated K. pneumoniae and E. coli as oral normal flora that colonized oral cavity and caused odontogenic abscess.

The predominant Streptococcus viridans groups were further subjected to antibiotic susceptibility test according to modified Kirby- Bauer disc diffusion. The results showed high sensitivity of isolates to amoxicillin (97%) followed by cefotaxime and imipenem represented by (94%) for each antibiotic, while (90%) of isolates were sensitive for ampicillin. These findings in agreement with Gregoire et al., [10], whose found that these bacteria were highly susceptible to amoxicillin, cefotaxime and ampicillin which are beta-lactam antibiotics and considered the first line of treatment for odontogenic infection. These bactericidal antibiotics convert their effect by inhibiting cross-linking peptide chains and prevent synthesis of peptidoglycan structure in bacteria cell wall [14]. The results also reflected high degree of sensitivity to metronidazole which reach (85%) and erythromycin (80%), respectively, while the sensitivity to azithromycin was (69%). These results compatible with study done by Amsterdam, [2] who described the major action of metronidazole which cause rapid inhibition of DNA replication by causing DNA strand destruction at concentrations easily attainable during routine drug administration, which only occurs after reduction of the nitro group. Also it is an antibiotic to which susceptible anaerobes have yet to develop clinical resistance; therefore it has been shown that there is excellent activity of metronidazole against odontogenic infections. Regarding sensitivity to erythromycin and azithromycin, this result is in agreement with the result obtained by Schwalbe [22] who found that sensitivity rates for erythromycin is (77.5%) among dental infections. Erythromycin and azithromycin are agents commonly used in dentistry belong to macrolides, acts by inhibiting protein synthesis through penetration of the cell wall of susceptible gram-positive and gram-negative bacteria and reversibly bind to the 50S ribosomal subunit. These agents are bacteriostatic in nature but can be bactericidal depending on microorganism and drug concentration. The newer macrolides, azithromycin have improved pharmacokinetics compare to erythromycin but they are not considered as first-line therapy in treating odontogenic infections, it can be used as a drug of choice in patients with penicillin allergy [23].

On the other hand, this study revealed intermediate sensitivity of isolates to tetracycline (66%), whereas lower sensitivity was recorded to doxycycline (36%), and very low sensitivity of isolates was
observed to clindamycin which was (18%). These stated results similar to results recorded by Zuckerman et al.,[25], who found nearly interrelated effect of these antibiotics used in treatments of oral infections. Tetracyclines are broad spectrum, bacteriostatic antibiotics, acting on both gram-positive and gram-negative bacteria through inhibition of protein synthesis by attaching to tRNA and prevent complexity of aminoacyletRNA with mRNA of 30s subunits of ribosomes while Clindamycin interfere in action with protein synthesis by bind to the 50s subunits of the bacterial ribosome subunit and inhibit protein synthesis, therefore this agent prevent production of bacterial toxins therefore it used as adjunctive therapy in toxic shock syndrome that caused by Streptococcus spp.[12].

CONCLUSIONS

We concluded that present results approve the existence of aerobic and anaerobic bacterial infection with the predominance of Streptococcus viridans groups in odontogenic infections. The study also showed high sensitivity of isolates to amoxicillin followed by cefotaxime and imipenem as drugs of choice for treatment of odontogenic infections.

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ETHICAL CLEARANCE

The Research Ethical Committee at scientific research by ethical approval of both environmental and health and higher education and scientific research ministries in Iraq

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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REFERENCES


