ERYTHROCYTE SEDIMENTATION RATE AND NEUTROPHIL COUNT AS PROGRESS MARKERS IN PATIENTS WITH ODONTOGENIC INFECTIONS

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ABSTRACT

The study aims to evaluate the level of serum ESR and neutrophil count (on admission day and 1 week post-operatively) in patients with odontogenic infections as a predictor for recovery state and progression of disease.

A prospective study was carried out on 20 patients suffers from odontogenic infections (abscess formation) admitted at oral and maxillofacial surgery department of al-Yarmok teaching hospital From October 2019 to May 2020; dental and facial examinations were made by specialist including the causal tooth (teeth), the involved fascial spaces, 5ml venous blood samples were taken from patients on admission to the hospital preoperatively and postoperatively one week after treatment for evaluation of Erythrocyte Sedimentation Rate (ESR) marker and neutrophil (N) cells counts.

The samples consist of eleven female (55%) and nine male (45%) patients with the mean age is (34.25±9.90) years, the most common facial space involved in infection was submandibular (40%) while the submental space was the least involved (15%); the preoperative serum ESR level and neutrophil count in patients on admission day was significantly higher compared with its level on day seven after treatment (P=0.000). Conclusions: Serum ESR and neutrophil count definitely prognoses the clinical progress of odontogenic infections and the appropriate duration of antibiotic consumption, thus these markers could be used as supervising tools for controlling the infection in patients with facial space infections of odontogenic source.

Keywords: Odontogenic infections, serum ESR, neutrophil count.

INTRODUCTION

Odontogenic infections are among the most popular emergencies in the dental office.¹ These infections involve teeth decay, gingivitis, periodontitis and periapical abscesses.² Patients with odontogenic infections should be monitored due to the high risk of deadly complications. Because potential spaces are
anatomically connected. Several odontogenic infections patients are admitted to a hospital due to the risk of infection with the deep spaces of the neck. [3].

One can classify odontogenic infections as either acute neutrophil-dominated inflammation or chronic inflammation characterized by inflammatory mononuclear cells. [4]. Erythrocyte Sedimentation Rate (ESR) tests the distance from which a vertical column of anticoagulated blood drops within an hour. It is a non-protein type of acute-phase reactants (APR), it alters in reaction to plasma fibrinogen and viscosity levels. [5]. Regarding soft tissue infections (fascia space infection), on admission, the ESR level can predict the infection severity and the hospitalization time. [6]

This study aims to evaluate the level of ESR and neutrophil count in patients with odontogenic fascia infections on day of admission and after surgical management and antimicrobial therapy for 1 week regarding recovery state and progression of disease.

**MATERIALS AND METHODS**

A prospective study was carried out on 20 patients suffers from facial space infections (abscess formation) related to dental origin admitted at oral and maxillofacial surgery department of al-Yarmok teaching hospital From October 2019 to May 2020.

Criteria for patient’s inclusion were not to receive any antimicrobial drugs before the surgical and medical management and all patients involved of fascial spaces infections of odontogenic origin only.

Criteria for patient’s Exclusion consisting of:

1- Patients with autoimmune diseases or Immunocompromised.
2- Patients received antimicrobial medicines for systemic infection 6 weeks before surgical management.
3- Severe systemic diseases: cardiac, renal failure, hypertension.
4- Pregnant female.

Patients information’s and detailed medical history were recorded, also dental and facial examinations were made by specialist oral and maxillofacial surgeon including the causal tooth (teeth), the involved facial space(s) (submandibular, buccal, submasseteric, submental). Subjective signs and symptoms were registered including pain, tenderness, fever (elevated temperature over 38°C) on admission day and all patients were hospitalized for 1-2 days after surgical management.

In the early afternoon, 5ml venous blood samples were taken from patients by venipuncture on admission to the hospital preoperatively and postoperatively one week after surgical management (incision and drainage or tooth extraction with removal of inflectional odontogenic focus) and antimicrobial medications prescription.
ESR inflammatory marker and differential White Blood cells (neutrophil (N) counts) were established preoperatively and 1 week postoperatively after management to verify patient’s progress and steady improvement towards normal value. Samples were assessed by a Sysmex XN-1000 auto analyzer during 30 minutes of sampling.

Reference Range for serum ESR:

Adult males: 0-17 mm/hour

Adult females: 1-25 mm/hour

Normal range of neutrophil count: 1.5 to 8.0 /mm³

Statistics:

SPSS (Statistical Package for social science) version 25 was applied for the statistical data analysis.

Data were introduced as the mean± standard deviation (SD); Paired t-test was utilized to compare the paired t-values (preoperatively and on day 7 postoperatively); Relationships between the parameters were assessed by Pearson’s correlation coefficient (‘r’ value). P-value lower than 0.05 was recorded to be significant.

RESULTS

A total of twenty emergency dental patients who clinically diagnosed with acute odontogenic infections enrolled in this study.

The study samples consist of eleven female (55%) and nine male (45%) patients with age range (20-56) years and the mean age is (34.25±9.90). Table (1).

In this study the most common fascia space infection involved was submandibular (40%) followed by submasseteric (25%), then buccal (20%) and lastly submental (15%). Table (2).

For all patients, on admission day, the mean level of serum ESR was (42.95±12) mm/1hr, while the mean level of serum ESR after 7 days of treatment and follow up was (21.65±8.06) mm/1hr. Table (3). so there was a significant difference between the ESR level on admission day and on day 7 after treatment by t-test relation (P=0.000), positive correlation could be seen in between the variables by Pearson’s Correlation (r=0.81). Table (4), Figure (1).

On admission day, the mean level of the neutrophil count was (9.24±1.40)/mm³ whereas, the mean level of the neutrophil count on day 7 after treatment was (6.51±0.92)/mm³ Table (3) this level was significantly lower than the mean level on admission day t-test (P=0.000), it showed a positive correlation between the variables by Pearson’s Correlation (r=0.62). Table (4), Figure (2).
Table 1: Patients Characteristics

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of patients</td>
<td>20</td>
</tr>
<tr>
<td>Age range</td>
<td>(20-56) years</td>
</tr>
<tr>
<td>Age Mean ±SD</td>
<td>(34.25±9.90) years</td>
</tr>
<tr>
<td>female</td>
<td>11 (55%)</td>
</tr>
<tr>
<td>male</td>
<td>9 (45%)</td>
</tr>
</tbody>
</table>

Table 2: Involvement of fascial spaces in odontogenic infections

<table>
<thead>
<tr>
<th>Fascial space involvement</th>
<th>Frequency</th>
<th>Percentage%</th>
</tr>
</thead>
<tbody>
<tr>
<td>submandibular</td>
<td>8</td>
<td>40%</td>
</tr>
<tr>
<td>submasseteric</td>
<td>5</td>
<td>25%</td>
</tr>
<tr>
<td>buccal</td>
<td>4</td>
<td>20%</td>
</tr>
<tr>
<td>submental</td>
<td>3</td>
<td>15%</td>
</tr>
<tr>
<td>total</td>
<td>20</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 3: Mean and standard deviation (SD) of serum ESR and neutrophil count on admission day & post-operatively (1 week) in cases group

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>N</th>
<th>Std. Deviation</th>
<th>Std. Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESR on admission day (mm/1hr)</td>
<td>42.95</td>
<td>20</td>
<td>12</td>
<td>2.68</td>
</tr>
<tr>
<td>ESR after 1 week of treatment. (mm/1hr)</td>
<td>21.65</td>
<td>20</td>
<td>8.06</td>
<td>1.80</td>
</tr>
<tr>
<td>Neutrophil count/mm³ on admission day.</td>
<td>9.24</td>
<td>20</td>
<td>1.40</td>
<td>0.31</td>
</tr>
<tr>
<td>Neutrophil count/mm³ after 1 week of treatment</td>
<td>6.51</td>
<td>20</td>
<td>0.92</td>
<td>0.20</td>
</tr>
</tbody>
</table>
Table 4: Statistical correlations of serum biochemical parameters in patients (pre and post-operatively)

<table>
<thead>
<tr>
<th>Paired Samples Test</th>
<th>T test</th>
<th>df</th>
<th>P value</th>
<th>Pearson’s Correlation ‘r’ value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lower</td>
<td>Upper</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ESR (on admission day)– ESR (after treatment for 1 week), (mm/1hr)</td>
<td>17.92</td>
<td>24.67</td>
<td>13.19</td>
<td>0.000</td>
</tr>
<tr>
<td>Neutrophil count/mm$^3$(on admission day) - Neutrophil count/mm$^3$(after treatment for 1 week).</td>
<td>2.21</td>
<td>3.24</td>
<td>11.06</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Figure 1: Serum ESR level (mm/1hr) on admission day & post-operatively after 1 week
DISCUSSION

Effective and proper intervention in an infectious condition can help to minimize the mortality and morbidity in dental practice. In infected patients, the symptoms and signs alone could not always be enough to assess the seriousness of infectious process and its clinical consequences. Both the clinical and inflammatory markers were applied to observe patients with odontogenic infections.

In the present study, the mean age of the demographic study was (34.25±9.90) years ranging from (20-56) years and a greater incidence was noticed in female (55%) than in male (45%) table (1), whereas other surveys reported that dental infection and facial cellulitis are more popular in children of school-age[7,8]. Other studies showed equal gender prevalence[9,10].

In our study, the most common fascia space involved in infection was submandibular (40%) table (2), due to increase the frequency of mandibular teeth as the origin of odontogenic infection. Similarly, Gholami’s et al[11] and Zheng et al[12] confirmed that Mandibular molars and submandibular space were the most commonly affected in odontogenic infections, other research reported that buccal space was the most commonly involved in infection[13].

In the current study, the submental space was the least involved in infection table (2), which might be due to reduced awareness towards oral health care measures, this result was similar to a study conducted by Prakash et al.[14].

Different markers of inflammation were used to help assess the clinical severity of infection; there is a definite correlation between the consequent inflammatory reaction and the inflammatory markers, such as erythrocyte sedimentation rate (ESR).
In this study, the preoperative serum ESR level in patients on admission day was significantly higher compared with its level on day seven after treatment \((P=0.000)\), tables (3, 4), fig. (1), as it acts as an acute-phase reactant.

Likewise, a research study of Shetty and Shah \(^{15}\) confirmed that ESR elevated certainly preoperatively in patients with odontogenic fascia space infection.

Furthermore, a study by Kaur et al \(^{16}\) verified that the preoperative level of ESR had a valuable correlation with the seriousness of odontogenic infection as well as the mouth opening and pain.

A study carried out by Sharma et al \(^{17}\) revealed that C-reactive protein (CRP) (a protein with acute phase reactant) could be an efficient marker for establishing strength of infection, effectiveness of treatment scheme and hospital stay duration in patients with fascia space infections of odontogenic source.

In the focused research, the mean serum level of the neutrophil count preoperatively was significantly elevated compared with its level postoperatively (after seven days of treatment). \((P=0.000)\), tables (3, 4), fig. (2), this might be due to that the neutrophils are the main leukocyte (>95%) enlisted to the oral and gingival tissue in reaction to bacteria \(^{18}\).

A study performed by Dogruel et al \(^{19}\) proved that the neutrophil-to-lymphocyte (N/L) ratio was directly linked with stay at hospital and doses of antibiotics in patients with fascia space infection.

Studies \(^{20,21,22}\) shown that the count of white blood cells (WBC) on admission day and postoperatively, could act as a predictor of hospital duration stay and infection severity in patients with facial space infections of odontogenic source.

CONCLUSION

The submandibular space was the most frequently involved in odontogenic maxillofacial infections.

Serum ESR and neutrophil count surely prognoses the clinical progress of maxillofacial infections of odontogenic source and the appropriate duration of antibiotic consumption, thus these markers could be used as supervising tools for controlling the infection in patients with fascial space infections of odontogenic source.

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


