Assessment the Role of Erythrocyte Sedimentation Rate and C-Reactive Protein Tests For Prediction Of Rheumatoid Arthritis Activity In Misan Province

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Abstract Rheumatoid Arthritis (RA) activity was assessed based on erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP) tests. The ESR and CRP tests were monitored in 25 Rheumatoid Arthritis diagnosed patients and 25 healthy approved cases of suspected patients from Misan Province. The sample comprised of 25 male and 25 females with ages varied from 21-68 years and body weights from 45 – 112 kg. ESR readings in RA diagnosed patients varied between 22 – 116 averaged 46.8 mm/h in patients case while those recorded in the healthy approved cases ranged between 4-18 averaged 8.4 mm/h. Differences between patients and control cases were statistically significant (P < 0.05). This approved that measuring ESR is a valid tool to predict RA among Misan population. CRP test showed only 2 negative results among RA patients compared with 15 negative results in healthy approved cases. CRP values in patients sample ranged between 10 mg/dl in 11 cases and 24 – 48 mg/dl in another 11 cases with only one highly extreme value of 96 mg/dl. In he healthy approved cases, CRP values ranging from 6-12 mg/dl were recorded in 10 cases and negative results in the rest 15 cases. Differences were highly significant (p< 0.01) indicating the validity of CRP test to predict RA cases. Both parameters varied among various age groups, gender and body weight classes. Apparently both ESR and CRP tests may help to find or monitor inflammation in acute or chronic conditions of rheumatoid arthritis.

Keywords: ESR, CRP, Rheumatoid Arthritis, Misan Province

1. INTRODUCTION

Rheumatoid arthritis RA is a chronic inflammatory autoimmune disease where the patient’s immune system attacks the body’s own tissues. Symptoms usually include pain, swelling and stiffness with some functional impairment. More general symptoms such as fatigue, loss of appetite and low-grade fever can also be observed in many patients (Harris 2005). The American College of Rheumatology (2002) stated that the age of RA onset is between 30 and 55 years and it affects women more than men (ratio 3:1) with prevalence varies from 0.5% to 1.5% of the population. According to Duhme (2018) there are many rheumatic disorders, with similar signs and symptoms which may overlap and need expert for diagnosis and treatment. RA patients are often at a higher risk for anxiety and depression (Arnett, 1988). In addition to causing peripheral symptoms, RA may also involve the cervical spine, causing pain in the neck and occipital headache (Goekoop-Ruiterman, 2005). Extra-articular features are common and may involve multiple organs, including the skin, eyes, lungs, and blood vessels. (Van-Gaalen, 2004). Physical therapy is effective in management of rheumatoid arthritis; there is evidence to support aerobic and strengthening exercises, transcutaneous electrical nerve stimulation, and ultrasound (Majithia, and Geraci, 2007) . Different measures are used for evaluating disease activity in rheumatoid arthritis. Laboratory tests such as the erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP) have been used as markers of inflammation, although there is still no clear consensus on when to use one, the other, or both (Kenman et al. 2008) . Among these tests CRP had become the more preferred serological marker for evaluating acute disease activity (Skogh et al., 2003). People with rheumatoid arthritis often have an elevated ESR, or CRP levels, which may indicate the presence of an inflammatory process in the body as reported by Mayo Clinic Staff (2021).

The present study aims at measuring the activity of Rheumatoid Arthritis (RA) disease among patients in Misan Province based on erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP).

2. MATERIALS AND METHODS

2.1. Sampling

The ESR and CRP tests were monitored in 25 Rheumatoid Arthritis diagnosed patients and 25 healthy approved cases of
suspected patients. The patients sample comprises of 15 male
and 10 females. While the control sample comprised of 15
female and 10 males. The age of healthy sample varied
between 21 – 55 year, those of the patients sample between
22-68 year. The weight of the healthy sample 45 – 87 kg and
for patients 65 – 112 kg. Blood samples were collected and
analyzed according to standard methods ESR by Westergren
method and CRP by ELISA method, as follows:

2.2. ESR Analysis Method
This method was developed by Westergren (1981-1968). The
most acceptable and indicative method of inflammation. Four
ml of venous blood is required and filled the Westergren tube
to the 0 mark. Mix with sodium citrate anticoagulants and
place the tube in the rack at room temperature. Readings were
taken exactly 1 hour later and read the millimeters from the
top surface of the column to the top of the RBC deposit.

2.3. CRP Analysis Method
0.5 mL of serum is to be diluted at 1:2 for a semi-quantitative
CRP test. It is necessary to dilute the serum until a positive
agglutination reaction is observed. the serum is diluted in a
serial double dilution. The serial double dilution procedure
used up to the sixth tube. Determine the thinning and dilution
factor for each tube. Prepare 6 groups of tubes. To tube #1
add 0.5 mL of serum and 0.5 mL of NSS. A positive CRP test
indicates a medical condition and can help the clinician in
resolving the patient's health condition.

3. RESULTS & DISCUSSION

3.1 ESR in Rheumatoid Arthritis Patients
ESR readings in Rheumatoid Arthritis (RA) patients compared
with the healthy cases from Misan province are shown in
Tables (1 & 2) respectively. It has been noted that ESR readings
ranged between 22 – 116 mm/h in 21 patients case (Table 1).
These values are significantly (P < 0,05) higher than those
recorded in the healthy case which ranged between 4-18 mm/h
(Table 5). The extreme values of 71 & 116 mm/h were recorded
in two patients only. The highest frequency (12 patients)
ocurred in the range of 15- 30 (av. 22.5) mm/h (Table 1). As
for the healthy cases (Table 5), the high frequency occurred
within the range 1 – 15 mm/h with an average value of 4-12
mm/h. Only one case has shown a high value of 18 mm/h for
the healthy case.

<table>
<thead>
<tr>
<th>ESR range</th>
<th>NO</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>30-35</td>
<td>12</td>
<td>22.5</td>
</tr>
<tr>
<td>45-30</td>
<td>5</td>
<td>37</td>
</tr>
<tr>
<td>60-45</td>
<td>2</td>
<td>57</td>
</tr>
<tr>
<td>75-60</td>
<td>1</td>
<td>71</td>
</tr>
<tr>
<td>90&gt;</td>
<td>1</td>
<td>116</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ESR range</th>
<th>NO</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-10</td>
<td>7</td>
<td>3.71</td>
</tr>
<tr>
<td>10-15</td>
<td>8</td>
<td>7.87</td>
</tr>
<tr>
<td>15-20</td>
<td>8</td>
<td>12.5</td>
</tr>
<tr>
<td>15&gt;</td>
<td>1</td>
<td>18</td>
</tr>
</tbody>
</table>

A high ESR test result may be from a condition that causes
inflammation, such as: Arteritis – Systemic vasculitis -
Polymyalgia rheumatica - Inflammatory bowel disease -
Kidney disease – Infection - Rheumatoid arthritis - Heart
disease - Certain cancers and other autoimmune diseases
(Mayo Clinic Staff, 2021). To compare our results in Misan
province with those for RA patients published by Mayo Clinic
in 2021 in which ESR values averaged 30 mm/h in patients and
12 mm/h in the control group. Our results are comparable with
Mayo clinic values for healthy cases, the patients values,
patients in Missan CRP values ranged between 10 mg/dl as mild value in 11 patients to moderate values of 24 – 48 mg/dl occurred in 11 cases and a single extreme value of 96 mg/dl (Table, 3). The above results are comparable to those obtained by Yousef et al. (2015) in Egypt who found positive CRP test in 54 RA patients but negative in 26 patients (67.5% versus 32.5%), the CRP values ranged from 0.6 to 65 mg/dl (Mean ± SD 18.1 ± 15.8).

The above results indicates that higher CRP levels are associated with greater RA disease activity. Indeed, CRP levels are widely used for monitoring systemic inflammation and disease activity in RA patients. CRP level is a component of several composite disease activity measures as suggested by Dessein et al. (2004).

As for the healthy control samples (Table 4), values ranged between 6 – 12 mg/dl in 10 cases while 15 cases showed negative results. To compare CRP values with patients cases (10 – 48 mg/dl), differences were highly significant (p<0.01) indicating the validity of CRP test to predict RA cases in Missan Province. According to Silva (2010), CRP test may be used to help find or monitor inflammation in acute or chronic conditions of rheumatoid arthritis.

### Table (3): Frequency of occurrence and average CRP readings (mg/dl) for RA Patients in Missan Province

<table>
<thead>
<tr>
<th>CRP</th>
<th>NO</th>
<th>AV</th>
</tr>
</thead>
<tbody>
<tr>
<td>-ve</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>5-15</td>
<td>11</td>
<td>10.4</td>
</tr>
<tr>
<td>15-25</td>
<td>5</td>
<td>24</td>
</tr>
<tr>
<td>55-45</td>
<td>6</td>
<td>48</td>
</tr>
<tr>
<td>&gt; 55</td>
<td>1</td>
<td>96</td>
</tr>
</tbody>
</table>

### Table (4): Frequency of occurrence and average CRP readings (mg/dl) for healthy cases in Missan Province

<table>
<thead>
<tr>
<th>CRP</th>
<th>NO</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-5</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>25-10</td>
<td>5</td>
<td>12</td>
</tr>
<tr>
<td>negative</td>
<td>15</td>
<td></td>
</tr>
</tbody>
</table>

### 3.3 Impact of Gender on ESR Readings

Data of Table (5) showed that ESR values in patients (averaged 46.8 mm/h) are high compared with those in healthy cases (averaged 8.4 mm/h). Differences are highly significant (p<0.01). As for the effect of gender, ESR values in male patients (34.5 mm/h) were less than those of females patients (59.1 mm/h). Differences between male and female patients were significant (p<0.05). On contrary ESR values in healthy males and females are nearly similar and differences are not significant (p>0.05), they varied between 8.1 - 8.8 mm/h.
3.4 Impact of Age on ESR Readings

It can be seen from the below data that ESR values increased with age in both RA patients but not with the control. However, patients with old ages recorded the highest ESR values 97.3 mm/h. As for comparison between ages, at the 50-59 years age group the patient recorded an average ESR 45.2 mm/h compared with only 9.0 mm/h in the control indicating the impact of age in increasing ESR and RA disease in turn (Table 6). Values of all age groups in patients are significantly (p<0.05) different from ESR of the same age group in the control sample.

<table>
<thead>
<tr>
<th>Age (year)</th>
<th>Patients</th>
<th>NO</th>
<th>Av. ESR (mm/h)</th>
<th>Healthy</th>
<th>NO</th>
<th>Av. ESR (mm/h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>29-30</td>
<td>4</td>
<td>21.5</td>
<td></td>
<td>29-30</td>
<td>9</td>
<td>8.7</td>
</tr>
<tr>
<td>39-40</td>
<td>5</td>
<td>25.4</td>
<td></td>
<td>39-40</td>
<td>7</td>
<td>8.7</td>
</tr>
<tr>
<td>49-50</td>
<td>9</td>
<td>46.9</td>
<td></td>
<td>49-50</td>
<td>3</td>
<td>9.0</td>
</tr>
<tr>
<td>59-60</td>
<td>4</td>
<td>45.2</td>
<td></td>
<td>59-60</td>
<td>5</td>
<td>9.0</td>
</tr>
<tr>
<td>69-70</td>
<td>3</td>
<td>97.3</td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

3.5 Impact of Weight on ESR Readings

For healthy (control) sample increasing weight has not led to a corresponding increase in ESR values. Correlation was weak ($r^2 = 0.4530$) (Table 7). On the other hand, ESR values in RA patients showed a clear ascending trend with the increase of body weight ($r^2 = 0.8631$). These data indicate the possibility of suffering from RA in overweight people.

<table>
<thead>
<tr>
<th>Patients Body Wt. (kg)</th>
<th>No.</th>
<th>Av. ESR (mm/h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>60-69</td>
<td>4</td>
<td>22.5</td>
</tr>
<tr>
<td>70-79</td>
<td>5</td>
<td>27.4</td>
</tr>
<tr>
<td>80-89</td>
<td>6</td>
<td>45.8</td>
</tr>
<tr>
<td>90-99</td>
<td>7</td>
<td>47.5</td>
</tr>
</tbody>
</table>
4. Conclusions

i. The significant correlation between ESR and CRP tests with Rheumatoid arthritis activity indicated the importance of performing both tests for evaluation.

ii. Both measures are useful for assessing RA activity and may enable physicians to easily assess the disease activity.

iii. Factors such as age, gender and body weight are essential for monitoring in RA patients.

REFERENCES


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Journal port Science Research
Available online www.jport.co
Volume 7, special issue 2024


