The Value of Diagnosing Lower Extremity Osteomyelitis Using Erythrocyte Sedimentation Rate
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Background

Diagnosing osteomyelitis in the lower extremity (LE) can be challenging(1). Early in the infectious process the clinical signs of osteomyelitis are subtle and may reflect those of a soft tissue infection(4). Inaccurate diagnosis can lead to significant comorbidities and negative outcomes, such as prolonged antibiotics and unnecessary amputation. Failure to recognize its presence leads to poor bone healing, progressive infection, and possible systemic infection(7).

The erythrocyte sedimentation rate has been suggested to be a useful laboratory test to diagnose osteomyelitis(OM). A study by Newman et al showed that OM was present in 100% of the patients whose ESR was >70 mm/h, however this only had a sensitivity of 28%(8). Malabu et al and Kaleta et al also conducted studies revealing an ESR >70 mm/h as an optimal cut off value to diagnose OM, with a sensitivity at 89.5% and specificity at 100%(6,3).

A prospective study by Ertugrul et al argued that an ESR level >65 mm/h was the optimal cut off value to predict the presence of OM. The erythrocyte sedimentation rate has been suggested to be a useful laboratory test to diagnose osteomyelitis. However, this only had a sensitivity of 28%. Malabu et al and Kaleta et al also conducted studies revealing an ESR >70 mm/h as an optimal cut off value to diagnose OM, with a sensitivity at 89.5% and specificity at 100%.

Methods

In order to investigate the accuracy of using ESR to diagnose OM in the LE, a retrospective review was performed on all inpatients suspicious for OM between June 2014-June 2016. This included 245 patients with an infected ulcer according to IDSA classification system. OM was confirmed with either MRI, ceretec, or bone biopsy. ESR was drawn upon admission to the hospital. ESR was drawn upon admission to the hospital. The ESR for each patient was then placed into a category of one of the following: ESR <65, 65-70, and >70 mm/h. The presence and location of OM was recorded as well. Data analysis was performed.

Results

Out of 245 patients suspicious for OM, 159 had positive OM confirmed by MRI, ceretec, or pathology. Regarding anatomical location, 38 had digital OM, 33 had hallux OM, and 88 had OM elsewhere (proximal to digits).

Despite the literature showing the optimal ESR cutoff value of 65-70 mm/h to predict the presence of OM, our study found that 66% of the patients had positively confirmed OM of a lesser digit had an ESR level less than 65 mm/h. For patients positive with hallux OM, 74% of the patients had an ESR less than 65 mm/h. For OM proximal to the digits, 60% were found to have an ESR less than 65 mm/h.

Listed below are the sensitivities, specificities, positive predictive values, and negative predictive values for each category of ESR which includes: <65, 65-70, and >70 mm/h.

<table>
<thead>
<tr>
<th>ESR mm/h</th>
<th>Sensitivity (%)</th>
<th>Specificity (%)</th>
<th>PPV (%)</th>
<th>NPV (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;65</td>
<td>45.2%</td>
<td>25.6%</td>
<td>52.9%</td>
<td>20.1%</td>
</tr>
<tr>
<td>65-70</td>
<td>6.9%</td>
<td>97.6%</td>
<td>84.6%</td>
<td>36.2%</td>
</tr>
<tr>
<td>&gt;70</td>
<td>47.8%</td>
<td>76.7%</td>
<td>79.1%</td>
<td>44.3%</td>
</tr>
</tbody>
</table>

Conclusions

Our most significant finding was that osteomyelitis of the toe had an ESR of <65 mm/h. 66% of the time(38 patients total had toe OM). Most of the recent ESR literature does not correlate the ESR with the location of the LE OM, making this study unique. This finding potentially indicates that the presence of osteomyelitis in areas of the foot with decreased vascular status may not affect the ESR as significantly. For example, several patients in this study did have toe gangrene, which was later confirmed positive for OM by pathology. One should consider the likelihood that toe osteomyelitis will not elevate the ESR significantly unless several toes, gas, or abscess is involved. Several patients that were negative for OM, but whose ESR was above 70 mm/h had severe infection including abscess or gas.

Also, for an ESR >70 mm/h our calculated sensitivity was 47.8%, while in the literature it has been documented to be around 89.5%. Our calculated specificity for an ESR >70 mm/h was 76.7%, which is also lower; in the literature it has been reported to have been 100%. The ESR has been found in the past to offer the physician treating lower extremity OM a simple, inexpensive, and minimally invasive means of evaluating bone infection. Based upon the findings in our study, in addition to the ESR, one must also take into the account the location of the OM and the presence or lack of blood flow.

This study may have been improved if wound size measurements were included. Recent studies have shown that a larger wound with osteomyelitis correlates with a higher ESR.

Currently we do not have adequate evidence supporting the fact that an ESR is an accurate method to diagnose OM. Larger, long term studies are needed to better define the role of this inflammatory marker.

References