



# Erythrocyte Sedimentation Rate (ESR)

Better to rely on the Gold standard Westergren



**RR Mechatronics**  
Masters of Measurement



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## ***Erythrocyte Sedimentation Rate (ESR)***

### ***Better to rely on the gold standard Westergren than an “alternative-ESR” in dire need of a disclaimer***

Diagnosing a patient is often no easy task, especially when the symptoms are non-specific like general malaise, headache, anemia, joint pains or pain in the abdominal area.

In such cases, depending on circumstances, ESR is often requested as a first test to identify whether the presented symptoms may have an inflammation-related cause.

In 21<sup>st</sup> century medicine, it seems obvious that the treating physician will request and will receive state-of-the-art test results. It would be a breach of confidence between the lab and the requesting physician if this were not the case....

### ***ESR, the test for multi-day inflammation***

The ESR results from proteins that have been released in the bloodstream as a reaction to necrotic tissue or a systemic disorder. Some of these proteins rise and fall quickly, while others like fibrinogen and immunoglobulins take longer. This makes the ESR the excellent measure for the longer-lasting inflammation. C-reactive protein (CRP) is one of the acute-phase proteins known for their fast increase and drop. Therefore, a separate test measuring only CRP, is only good at identifying a recently-started inflammation.

### ***The key role of ESR in diagnosis***

The following diseases are not always clear-cut to diagnose, but still the accompanying high ESR value often plays an important role in their diagnosis or confirmation:

- Rheumatoid arthritis follow-up<sup>1</sup>: Accurate ESR helps detect a remission, which needs to be hit fast and hard with medication, and then again the lowest permissible dose needs to be found.
- Temporal arthritis<sup>2</sup>: ESR is important in a time-critical diagnosis with risk of losing vision.
- Multiple Myeloma<sup>3</sup>: next to the unspecific initial symptoms, a high ESR is a strong indicator.
- Anemia of inflammation: ESR is an excellent marker for the second most prevalent anemia after anemia from iron deficiency<sup>4</sup>.
- Periprosthetic joint infection<sup>5</sup>: ESR helps to discriminate between an infection and an aseptic etiology.
- Tuberculosis<sup>6</sup>, behind HIV, worldwide the second largest single infectious killer-agent: ESR is a very affordable first indicator in the TB diagnosis.

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## *The gold standard Westergren and alternative-ESRs*

Erythrocytes show the peculiar behavior of aggregating into rouleaux. When confined inside a pipette, these rouleaux will sink as they are heavier than the surrounding plasma. With the sinking rouleaux, the plasma will be displaced upwards. This causes a shear force on the rouleaux that will disperse the aggregation again, hindering their sedimentation. This sinking and dispersing forms a delicate balance steered by the acute-phase proteins. Westergren has set the standard for this phenomenon by defining the precise dimensions of the pipette and the procedure.

To further increase its diagnostic value, the international committee for standardization in hematology (ICSH) decided in 1993 to standardize a dilution step to reduce the hindering influence of an individual's high hematocrit level<sup>7</sup>.

So-called alternative-ESR methods like Diesse Alifax Test-1 and Alcor iSED, lack the dilution step that reduces the influence of high hematocrit. Alifax Test-1 and Alcor iSED limit their measurement to the aggregation phase, while not taking the disaggregation effect into account. This is limiting the compatibility with the Westergren ESR.

## *Misleading results of alternative-ESR*

1. Several researchers have published on disturbing results with alternative- ESR methods (this list is not exhaustive):
2. While the follow-up of **rheumatoid arthritis** often takes decades, detection of recurrent increase in disease activity is of importance to avoid unnecessary damage. The 2010 paper of A. van der Maas et al., "The use of different methods for rapid determination of the ESR induces DAS28 misclassification in clinical practice"<sup>1</sup>, raises the concern that the accuracy of the alternative-ESR is of so little use that the result obtained at the previous visit, three months earlier, could have just as well been used.
3. In **temporal arthritis** diagnosis, the ESR is used as a confirmation of the diagnosis. H. Bernelot Moens (2015) reported that he did not trust the alternative-ESR results of several patients. And indeed, after retesting using the gold standard manual Westergren method, the diagnosis was confirmed with a very high ESR and later with a biopsy<sup>2</sup>. Again, alternative-ESRs can lead to misleading results and delay proper diagnosis.
4. **Multiple myeloma** detection remains challenging due to the unspecificity of the symptoms<sup>8</sup>. M.T.H. Rajmakers et al. (2008) investigated the effect of different M-protein classes on ESR in Westergren and alternative-ESR. With a large divergence of ESR values above 40 mm, they conclude that "[the alternative-ESR] Test-1 is not a good indicator for the detection of patients with a M-protein"<sup>3</sup>. The often too-low ESR value with M-proteins of the alternative-ESR is misleading for a correct diagnosis, which consequently increases the latency before the start of treatment.

### **More issues with alternative-ESR**

The inconsistency of the results is not only problematic when under-estimating or totally missing some high ESRs that accompany some typical disorders, leading to false negatives. The variation between the results also causes an elevated number of false positives that may lead to unnecessary further investigation, which in turn can bring discomfort to the patient as well as additional costs.

Also, and no less disturbing, the controls that are used to verify the functioning of the alternative-ESR systems show a very different value or even no value when these are tested following the gold standard Westergren.

### **Alternative-ESR in dire need of a disclaimer**

In conclusion, publications show the results of the alternative-ESR tests to be misleading, at least in the case of rheumatoid arthritis, temporal arthritis and multiple myeloma.

Message to the lab manager: when you receive a serious ESR request, please refer to a method that complies with the gold standard Westergren.

Message to the requesting physician: Check whether your lab uses alternative-ESR. If so, be sure to explicitly ask for a Westergren ESR.

***We, the team of RR Mechatronics,  
believe that every patient deserves  
the right diagnosis and care***

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