Electronic counter-related pseudoleukopenia: more than a rare occurrence

Electronic counter-related pseudoleukopenia can change clinical decisions. By using a comparative analysis between the electronic counter-related white blood cell count and the count obtained by a direct leukocyte count we show that this pseudoleukopenia might be not rare in patients with increased leukocyte adhesiveness/aggregation.

Electronic counter-related pseudoleukopenia has been previously reported. We conducted a study to see how increased leukocyte adhesiveness/aggregation (LAA) affects the results of the electronic counter white blood cell count (ecWBCC). We investigated 496 patients with pneumonia, urinary tract infection, soft tissue infections, sepsis, upper respiratory tract infections as well as various viral and rheumatic diseases aged 62±24 years and 112 controls with a mean±SD age of 35±14 years. Peripheral venous blood was obtained for ecWBCC in EDTA vacutainer tubes using an electronic (Coulter electronics) counter and for the leukocyte adhesiveness/aggregation test (LAAT) using an image analyzer (imWBCC) as described elsewhere. As a standard against which to test the ecWBCC, we used an image analyzer-based estimate of leukocyte count (imWBCC). This estimate has no bias related to leukocyte aggregation. A calibration factor converting the total number of leukocytes counted by the image analyzer to leukocytes/mm² is obtained as follows. The median ratio between the ecWBCC and the total leukocyte number counted in each slide is calculated, taking into account only those slides with an aggregation level of up to 10% obtained in young controls who have minimal aggregation. By doing this, it is possible to circumvent the electronic counter underestimated leukocyte count. Multiplying the total leukocyte number by this factor for each slide yields an image analyzer (im)-based WBCC reading (the imWBCC).

To test for possible bias in ecWBCC at high levels of aggregation, we calculated the ratio ecWBCC/imWBCC for samples with high aggregation levels, i.e., an aggregation of >20%. There were 264 such samples in the infection/inflammation group and none in the control group. Figure 1 shows a histogram of the ecWBCC/imWBCC ratio for high aggregation samples (note that the ratio was below 0.5 indicating 50% bias for 12 patients, and that it was below 0.4 indicating 60% bias for 4 patients). Figure 2 shows the corresponding histogram for the 45 samples from patients with infection/inflammation and an aggregation of <10%. We compared confidence intervals for the medians of the underlying distributions. The 95% confidence intervals for the median of ecWBCC/imWBCC for these subgroups were calculated by half population jack-knifing. The results were: (0.78, 0.86) for aggregation >20% and (0.92, 1.18) for aggregation <10%. The significance level (also computed by jack-knifing) for the hypothesis that the median is smaller for the high-aggregation population is 2×10⁻⁴. This is a proof that increased LAA causes a negative bias in ecWBCC.

We conclude that increased LAA in the peripheral blood of patients with acute infection/inflammation is common and might influence the WBCC obtained by using an electronic counter. Physicians should be aware that a WBCC within normal limits obtained by an electronic cell counter in a patient with infection/inflammation, could be an underestimate. These results were recently strengthened in a model in which the patient participated as his or her own control following the infusion of a leukocyte-aggregating agent.

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References