Letters to the Editors

Pseudoleucocytosis due to cryoglobulinaemia

We report a case of pseudoleucocytosis observed on routine electronic cell counting due to a circulating monoclonal IgM cryoglobulin. Although cryoglobulins have been described in patients with various underlying infections and neoplastic and autoimmune diseases as well as in individuals with no apparent disease,¹ it is not widely known that falsely high leucocyte counts may be obtained in such patients when electronic cell counters are used to perform blood counts.

Case report

A 55-year-old fit-looking Caucasian man had an automated full blood count carried out which showed a haemoglobin concentration of 12.0 g/dl with an unexpectedly high leucocyte count of $54.0 \times 10^9/l$. Examination of a peripheral blood film, however, was consistent with a normal leucocyte count, and a manual count performed using a counting chamber gave a value of $7.4 \times 10^9/l$. Close scrutiny of the peripheral blood smear revealed bluish-staining globules, presumably proteinaceous in nature, present throughout the smear. A full blood count repeated on a prewarmed blood specimen at 37°C showed a normal leucocyte count of $8.4 \times 10^9/l$ and strengthened the suspicion

of the presence of a cryoprotein interfering with leucocyte counting. The total serum proteins were 70 g/l with an albumin of 43 g/l and a cryocrit of 5%. The cryoprotein was characterised as monoclonal IgM with kappa specificity using immunoelectrophoretic techniques. Serum was also examined at 37°C, 25°C, and 4°C for the presence of cryoglobulin particles using the Coulter Counter model TAIL, which can count particles of 15 different volumes and sizes simultaneously. Results shown in the Figure clearly demonstrate that the spuriously elevated leucocyte count was indeed due to the presence of particles of cryoglobulin being counted as white blood cells.

Spurious erythrocyte indices can be obtained on the model 'S' Coulter Counter due to cold agglutinins.^{2,3} It is not, however, generally appreciated that falsely elevated leucocyte counts can be obtained in the presence of cryoprotein. Emori *et al.*⁴ described a case of pseudoleucocytosis with cryoglobulinaemia in which they attributed the spuriously elevated leucocyte count to particle formation between cryoglobulin and fibrinogen. Taft *et al.*⁵ reported similar findings due to cryoprotein crystals. However, neither of these authors made any attempt to size these protein particles accurately using electronic particle counters. In our patient, we have seen small, round, proteinaceous globules in smears made from blood at

room temperature and at 4°C but not at 37°C. We have obtained data from particle counting on the patient's serum, using the Coulter Counter model TAIL, to confirm the presence of aggregates at 4°C and 25°C, the particle size ranging from 3.5 to 24 µm and from 3.0 to 16 µm, respectively, which can adequately explain the pseudoleucocytosis observed in our case. The range of particle size in question would normally be quantitated by a Coulter Counter model 'S' (aperture 100 µm), which is routinely employed in most hospital laboratories. We therefore recommend that any unexpectedly high leucocyte counts, which are not confirmed on examination of a stained blood film, should be checked by repeating the count at 37°C when the discrepancy will become obvious.

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Effect of temperature on number and size distribution of particles in patient's serum.

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