A PHARMACOLOGICAL METHOD OF EXTENDING THE USEFUL STORAGE LIFE OF BLOOD

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Williams & Morris, (1980) have suggested that the limited storage life of blood is due to structural changes in red cells involving cell shrinkage, and an increased cell density, haemoglobin concentration and internal viscosity. This results in a slowed passage through the spleen, and reduced lifespan due to accelerated sequestration. We have confirmed these structural changes, reversed them and determined whether such "rejuvenated" cells have regained their lifespan following re-infusion.

Blood was obtained from human volunteers, anticoagulated and stored. Cell density was measured against a solution of known density, and cell flexibility measured via the cells' passage through a micropore filter. Haemoglobin concentrations and cell volumes were measured by standard methods.

Following storage for periods up to 42 days, blood samples were removed, incubated with fresh autologous plasma and treated with nystatin (30 µg/ml) and a range of K^+ concentrations (50 - 500 mM). Following treatment the cells were thoroughly washed. A concentration of 90 mM K^+ in the presence of nystatin was found to re-inflate the cells so that their cell volume, haemoglobin concentration and density were the same as those for fresh cells. The changes in cell density are shown in Fig 1.

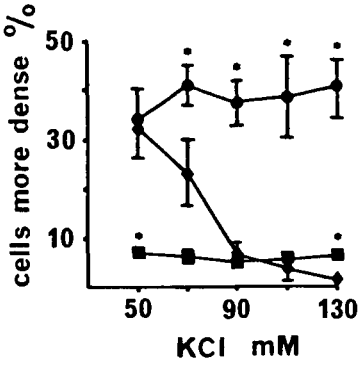

Fig 1. The change in density of red blood cells treated with KCl for fresh cells (■), 21-day stored cells (●), and stored cells treated with nystatin (◆). Density is expressed as the % cells more dense than a standard (d = 1.098 g/ml).
n = 6 ± s.e.m., * indicates $P < 0.05$.

Selected experiments using rabbit blood showed that the same structural changes occurred, and that they could be reversed by treatment with nystatin and K^+. Using the radiochromium method of determination of cell lifespan, treated blood was re-infused and the cells' survival time found to be 22.7 days (± 1.6) as compared to 21-day stored cells untreated with nystatin (15.6 ± 1.1). The lifespan of red cells from fresh blood was 28.9 ± 2.5.

The method described will prove unsatisfactory for routine use because of the amount of manipulation of the samples. At this stage we only record the possibility that the changes in red cell structure that limit the duration of whole blood storage can be reversed by a chemical process.

Williams, A.R., Morris, D.R. (1980) Scand.J.Haematol., 24: 57-62.