297 A NEW, RAPID METHOD FOR ESTIMATION OF RED CELL MASS IN NEONATES GIVEN BLOOD TRANSFUSION.

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We have estimated red cell mass (RCM), using a new method based on dilution of HbF by donor HbA, in 31 infants requiring blood transfusion (Tx). In Group 1, a third of the babies, Tx was for acute, early losses within 10 days of birth, whereas in Group 2 (20 infants), Tx was usually for 'anaemia of prematurity' compounding earlier, more gradual blood losses & was given between age 16 and 70 days, median 31 days after birth.

In Group 1 the low values for RCM are associated with marked hypovolaemia in those infants undergoing haemodilution after acute blood losses: RCM ($\bar{x} \pm$ SD) = 17.1 $\pm$ 3.9 ml/kg (Range 12.6-23.1)
Total blood volume (TBV) 54.2 $\pm$ 14.5 ml/kg (Range: 29.4-77.0)
Hb 10.6 $\pm$ 1.3 g/dl (Range 9.0-13.6)

Group 2: severe hypovolaemia also marks the later anaemia in such infants, since the (calculated) plasma volumes are contracted, partly masking the anaemia:
RCM = 19.3 $\pm$ 6.7 ml/kg (Range: 12.5-39.9)
TBV = 65.9 $\pm$ 22.3 ml/kg (Range: 38.0-137.6)
Hb = 9.6 $\pm$ 1.2 g/dl (Range: 7.5-11.4)

This method extends assessment of the impairment of O_2 supply from the blood, after perinatal blood losses and in later anaemias.

298 MEASUREMENT OF PLASMA VISCOSITY - COMPARISON OF FOUR VISCOMETERS.

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For more then two decades, only the Harkness-Coulter viscometer was commercially available in routine clinical plasma viscosity testing. Three new clinical viscometers (manufacturers: Haake, FRG; Luckham, UK; Rheomed, FRG) have been compared to the Harkness viscometer in an extensive quality control program. Sample-to-sample, day-to-day and long term variations have been studied and compared, furthermore error sources, health and environmental hazards, sample volume, price, running costs and user friendliness have been evaluated. Among the four machines tested, the Luckham viscometer appeared to be the most versatile, especially because of its reliability and user friendliness. The smallest sample volume (10 times less than any of the others) is required by the Haake falling ball microviscometer. It provides repeated tests from a sample volume less than 0.1 ml, at comparable price, and with still acceptable accuracy. The exactness of the Rheomed machine is jeopardized by the varying diameter of disposable plastic capillary tubing used in this method.

299 VENOUS OCCLUSION TIME AND POSTURE INFLUENCE HEMORHEOLOGICAL MEASUREMENTS.

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The quantification of blood rheology includes a number of errors, of which venous occlusion time and postural changes have not been studied systematically as yet. It can be shown that venous occlusion is associated with a time dependent hemoconcentration of samplus withdrawn distally from the cuff. This phenomenon is probably due to water loss from the intravascular space, while cells and macromolecules are held back. Postural changes from the vertical to the sitting or horizontal position are associated with a significant fluid shift into the intravascular space leading to hemodilution. Hemorheological variables are highly sensitive to these alterations. In order to avoid artefacts these variables need to be controlled in clinical trials. In order to ease interpretation of results the method of doing so should be described in publications.

300 ARTIFACTS OF BLOOD FILTRATION PROCEDURES: FACT OR FICTION.

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The flow rate of blood cell suspensions through Nuclepore membranes are influenced by a) the occlusion of pores by white cells and platelets b) the haematocrit of the suspension and c) the viscosity of the suspending medium. These factors are thus considered to introduce artefacts into the technique and it is commonly believed that filtration methods are of no value in assessing red cell deformability unless plasma, platelets and white cells are removed before the test is performed. We have measured flow profiles of dilutions (1/15 to 1/100) of whole blood in buffered saline through 3 u Nuclepore membranes. The flow profiles are markedly different due to differences in the number of red cells, white cells, platelets and different amounts of plasma in the suspensions. However the calculated pore-occupation times of the red cells (see Jones et al, 1985) is the same in all cases (about 0.5 seconds). Increasing the viscosity of the suspending medium four-fold by the inclusion of Dextran -40 produced no change in the pore-occupation of the red cells. We conclude that none of the above factors should be adjusted arbitrarily to produce a 'standardised' test. Any influence they may have on the calculated pore-occupation time of the red cells is not an artefact but a direct effect on the flow properties of the red cells.

Jones et al, 1985 Brit. J. Haematol. 59, 541-546.

301 A NEW TECHNIQUE TO ASSESS THE DEFORMABILITY OF RED AND WHITE BLOOD CELLS

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The pathological importance of abnormal blood cell rheology in ischaemic disorders has been widely investigated during the past decade. There continues to be a need for a simple, accurate and clinically applicable technique which can distinguish between transit and clogging of different blood cells in a filtration system.

The St. George's Blood Filtrometer measures independently blood cell transit time and the clogging rate in a constant pressure system by accurately detecting the filtration rate of three successive small volumes (3 x 2o µl) of blood cell suspension at the beginning of filtration. From this data the initial cell filtration rate and transit time as well as the clogging rate are calculated automatically. The method is able to exclude some of the artefacts which have interfered with previous blood cell filtration techniques: (1) cell sedimentation on the surface of filter membrane, (2) early decrease of filter capacity by pore clogging, (3) unphysiologically high and varying perfusion pressure. The St. George's Blood Filtrometer gives reproducible results with a C.V. of less than 5%. This new technique has now been applied clinically and rheological abnormalities in the red and white cells have been demonstrated in different diseases.

302 THE RHEOSCOPE:A MICRORHEOLOGIC TECHNIQUE FOR DIRECT OBSERVATION OF IN VITRO FLOW BEHAVIOR OF RED BLOOD CELLS(RBC).

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Most microrheologic techniques used to measure in vitro flow behavior of RBC lack the possibility of direct observation of the cells. The Rheoscope,first introduced by Schmid-Schönbein(Microvasc.Res.6,366 1973)is a unique device which allows observation and measurement of non attached RBC under shear flow.Its major component is a transparent counter-rotating cone-plate chamber,mounted on a microscope stage(Leitz Diavert).Cones of various angles can be used(0.5°-4.5°).Cone and plate, each fixed on a ball bearing,are rotated via a rubber cone by a speed controlled servo motor.RBC suspended at various hematocrits between 2% and 45% in plasma or artificial media with increased viscosities,changes in pH and/or osmolality are transferred into the chamber.By focussing on the stationary layer of the shear field,using either interference or phase contrast optics,cells are observed at a radial distance of 1000-1500µm from the center of rotation.At this distance RBC flow is unaffected by cell-wall interactions,hardly any translational movement is found.RBC flow and deformation behavior is observed directly over a wide range of shear stresses,photomicrographs and cinematographic records can be taken for further evaluation.The Rheoscope provides information on the motion of the cell membrane and cell content, the influence of various cell shapes and cell ages on their deformation and the effects of cell-cell interactions.Recent changes in the optics enable the analysis of deformation behavior of cell populations from diffraction patterns.Supported by Deutsche Forschungsgemeinschaft PF 184 / 1-1.