WGPPM—Abstracts for Oral Presentations

273 THE EARLY ANEMIA OF MAMMALS, COMPARATIVE STUDIES P Holter, A Hågå, P Hågå, T. Sanengen, J Widnes and S Halvorsen, Depts Paed & Path, Ullevål

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Since hematocrit is one of the main determinants of blood viscosity, the regulation of erythrocyte production is important in maintaining normal blood viscosity. Hemoglobin/hematocrit, erythropoiesis stimulating factors, ESF, 2,3-DPG and P50% were studied in preterm infants, rabbits, rats and mice. Only the human newborn has postnatal polycythemia, the other species had hematocrit similar to the adult levels. Following birth hb/hct drop in almost all mammals reaching the nadir at the time of weaning. In the human the nadir is unrelated to this event. The development of the anemia occurs when the animals are growing rapidly and in rabbits there is a correlation between degree of anemia and weight gain. The anemia does not hamper growth rate. At the nadir ESF is increased in the species studied and there is a correlation between the concentration of ESF and weight gain. In rabbits 2,3-DPG increases following birth and the available oxygen does not change during the development of the anemia. Thus the low hb conc. does not reduce the oxygenation of the tissues to a degree which give marked changes. The early anemia is iron responsive in most species studied, suggesting that it may be related to environmental causes. The early anemia of prematurity is not alleviated by peroral iron. The rapid changes in hematocrit observed following birth must be taken into consideration in all hemorheological studies.

274 THE EFFECT OF LIGHT AND HYPEROXIA ON OCULAR BLOOD FLOW IN THE NEWBORN PIGLET. T. Stiris, T.W.R. Hansen, L. Mørkric, D. Bratlid. Department

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The effects of light and hyperoxia on ocular blood flow were studied with the microsphere method in six newborn piglets. Under nitrous oxide anesthesia supplemented with azaperone/metomidate the necessary catheters were placed and a tracheostomy performed. After a stabilizing period of one hour, in which the piglets' eyes were shielded from light, baseline blood flow values were obtained. The piglets were then exposed to light by placing a standard phototherapy unit consisting of 4 daylight fluorescent tubes over the head, giving approx. 4 $\mu\text{W}/\text{cm}^2/\text{nm}$ in the 450 nm region at the eye level. After one hour of light exposure another measurement of ocular blood flow was performed. The piglets were then made hyperoxic by breathing 100% O_2 for one hour. This caused the arterial pO_2 to rise from 11.8 $\pm$ 3.1 kPa to 43.1 $\pm$ 11.9 kPa (mean $\pm$ SD) when the last blood flow measurement was done. Light exposure caused the ocular blood flow to increase from .81 $\pm$.32 ml/g/minute to .99 $\pm$.38 ml/g/minute ($p < .05$, two-tailed t-test). Later exposure to hyperoxia reduced this flow to .86 $\pm$.29 ml/g/minute ($p < .05$ when compared with flow under illumination). The results indicate that both light and hyperoxia affect ocular blood flow in the newborn piglet, but in opposite directions. If the increased flow observed during illumination reflects increased metabolic demands, light exposure might be harmful during periods when oxygen delivery is limited. The increased incidence of retinopathy of prematurity attributed to illumination may be related to changes in ocular blood flow.

275 PATTERNS OF SIMULTANEOUSLY MEASURED paO_2 AND paCO_2 LEVELS IN NEWBORNS (NB) DEVELOPING RETINOPATHY OF PREMATURITY (ROP). E. Bossi, F. Koerner, C. Wetzel, Dept. of Pediatrics, Eye Clinic, University of Bern, Switzerland.

The physiological paO_2 and paCO_2 levels at which retinal maturation occurs cannot be maintained after birth. This can lead to disturbed vascularization and to ROP. 2 hypotheses on the relation between paO_2 , paCO_2 and ROP were tested for their consistency with clinical observations: 1. Concomitant hyperoxygenation and hypocapnia cause a decrease of retinal perfusion inhibiting vascular growth. Later resumption of vascular development results in proliferation and ROP. 2. Concomitant high paO_2 and high paCO_2 lead to vasodilatation, hyperperfusion and increased transmural pressure resulting in vasoproliferation and ROP. Question: Does the pattern of simultaneously measured paO_2 and paCO_2 differ between NB developing ROP and controls? Method: 3 groups of ROP-NB (n=58) and controls (54) were formed: 4:25-21 weeks gest. age; 8:32-40 w.; C: blind infants (RLF, n=3) and their controls, 25-30 w. For each of the first 7 days of life, mean paO_2 , the 2 highest individual paO_2 and paCO_2 levels were averaged in each group and related to the mean of simultaneously measured paO_2 or paCO_2 values. Results: Groups A and C: The paO_2 and simultaneously measured paCO_2 parameters as well as the highest paCO_2 levels consistently showed higher values in the ROP- and RLF-NB than in the controls; paO_2 values accompanying highest paCO_2 values were elevated in group C. Group B: No difference was found between ROP-NB and controls. Conclusions: Disturbed maturation of retinal vasculature with development of ROP is associated with a combined elevation of paO_2 and paCO_2 . No such association was found at gestational ages above 31 weeks.

276 EFFECTS OF OXIDANT SUBSTANCES ON ERYTHROCYTE DEFORMATION: CHANGES INDUCED BY ISOURAMIL (ISO) AND MALONYLDEALDEHYDE (MDA).

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The addition of isouramil, an aglycon derived from broad beans, has the capacity to form hydrogen peroxide and free radical metabolites. Hydrogen peroxide, if not detoxified by the glutathione peroxidase system, can cause damage to RBC membranes by lipid peroxidation. MDA, a breakdown product of lipid hydroperoxides in biological systems, causes similar peroxidation of endogenous membrane phospholipids as well as a decrease in band 1 and 2 of spectrin and an increase in high molecular weight protein polymers. This study was designed to investigate the effect of these alterations on RBC microrheologic behavior in vitro. Human RBC were exposed to ISO (1mM) and MDA (5, 10, 20 μM). Using a cone-plate Rheoscope RBC deformation was observed and measured over a wide shear stress range (2.5-500 dyn/cm²). Without changes in cell shape or volume cell deformation decreased significantly at low shear stresses for all experiments and over the whole shear stress range for cells treated with 10 or 20 μM MDA. The addition of glucose (5mM) during the incubation period prevented the ISO induced changes in deformation. The results suggest that the polymerisation of membrane components may enhance sequestration of aging cells or cells exposed to autooxidizable substances. Supported by DFG grant PF 184/1-1

277 LASER DOPPLER MEASUREMENT OF SKIN BLOOD FLOW IN NEWBORN INFANTS B. Strömberg, T. Riesenfeld and G. Sedin. Department of Paediatrics, University Hospital, S-751 85 Uppsala, Sweden

It has previously been very difficult to determine the role of skin blood flow in temperature regulation and water balance. Measurement of skin blood flow in newborn infants has earlier been possible only on peripheral parts of the body and with methods that may disturb the infant and probably also influence the skin blood flow. The laser Doppler technique has made it possible to measure skin blood flow on both central and peripheral parts of the body without discomfort to the infant.

In order to investigate the role of skin blood flow in the heat and water balance of newborn infants we measured skin blood flow in the scapular skin area with a He-Ne laser Doppler flowmeter. The infants were fullterm and appropriate for gestational age.

In one series of measurements the incubator temperature was kept above the thermoneutral zone and the skin blood flow, evaporation of water from the skin and body, skin and ambient temperatures were recorded. In another series measurements of the same variables were made before and after removing vernix caseosa from the skin surface. As the skin blood flow of infants was studied in a warm incubator an unheated measurement probe was used.

The most important results from these studies were that, in calm infants' skin blood flow decreases during the first three hours after birth, and that the infants' skin blood flow increases with increasing activity. In infants nursed in a warm environment skin blood flow increases when the infants' body temperature rises. In infants who sweat feeding of a glucose solution with a temperature of 10°C causes a sudden decrease in skin blood flow. Washing the infants' skin with a mild detergent solution increases the skin blood flow during the following hour.

278 POSTNATAL CHANGES IN SKIN VASCULAR TONE RECORDED BY TRANSCUTANEOUS PO_2 ELECTRODE AT 37°C. G. Ahlsten, U. Ewald, M. Kobbah, T. Tuvemo. Dept Paediatr Uppsala, Sweden.

Postnatal circulatory adaptation is characterized by increased peripheral vascular tone and redistribution of blood flow. This view is supported by the results of this study with a new non-invasive technique.

A transcutaneous PO_2 electrode (Transoxdore[®], Dräger, FRG) used at a temperature of 37°C has been shown to detect changes in PO_2 at the skin surface reflecting changes in blood flow in a defined area of skin vasculature. Postischaemic hyperaemia was measured after 4 min of cuff occlusion of the forearm circulation.

Twelve vaginally delivered, non-asphyxiated, healthy, term and appropriate for gestational age neonates of healthy drug-free mothers were studied 4-7h and 24-32h post partum.

The newborn infants demonstrated a higher basal blood flow 4-7h after birth (median 1.7 kPa, range 0.1-3.1) than at the later registration (median 0.2, range 0.0-0.5) ($p < 0.01$; sign test). On the other hand they showed a lower postischaemic increase in transcutaneous PO_2 on the first occasion (median 0.0 kPa, range 0.0-1.3), while this was significantly improved at the later registration (median 0.8 kPa, range 0.3-1.6) ($p < 0.05$). The maximum postischaemic peak, was not significantly increased.

Peripheral circulation in the fetus is characterized by high blood flow and low perfusion pressure. The postnatal circulatory adaptation in the skin was readily detected by this new non-invasive technique. Skin vascular tone increased markedly as measured by decreased basal tcPO_2 . The capacity for a vasodilative response to hypoxia increased significantly during the first day of life indicating improving regulatory control of the vascular bed.