Effects on the infant of obstetric regional analgesia

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In an investigation carried out at the University Hospital in Uppsala, 88 parturients were chosen at the maternity department because they fulfilled a number of specified normal criteria, and they agreed to participate regardless of the form of analgesia which we chose for them. The mothers were divided into a control group, an epidural group and a group which received paracervical and pudendal nerve blockade with lidocaine-adrenaline. The mothers of the control group received 50 per cent nitrous oxide in oxygen during the contractions. For comparison with the control and analgesia groups a study was also made of 37 deliveries at risk, which resulted in 22 infants with intrauterine asphyxia. The deliveries were electronically monitored. After birth the newborn infant was transferred to a preheated incubator and intensely supervised for the first two hours. We recorded the ECG, respiration, motor activity and arterial blood pressure. Repeated blood samples were taken for blood-gas analysis and for analysis of blood sugar, lactate, pyruvate, glycerol, free fatty acids, beta-hydroxybutyrate and lidocaine concentrations. During the first week of life we made repeated neurological examinations as described by Prechtl and Beintema and also quantitative studies on the sucking behaviour. When the infants were 18 months old a follow-up was made, consisting of history-taking, clinical neurological examination and an assessment of the psychomotor development by the method of Griffiths. - The analysis of this material is far from complete as yet, but a few glimpses of the results of different types of investigations and from different phases of the project will be given.

The maximum plasma lidocaine concentrations in the infants of the analgesic groups varied between 0.06 and 0.8 ug/ml. The Apgar score at 1, 5 and 15 minutes and the blood gases, acid-base and lactate during the first 2 hours did not differ significantly between the control and analgesia groups.

Calculation of the neonatal heart rate variability was based on the standard deviation of the R-R duration of successive 10 second epochs of the ECG records made during the first 2 hours. When we divided up our material in different ways we found differences between groups with respect to the heart rate variability. Thus, the control group, of infants of multiparous mothers, had the greatest heart rate variability. Then followed the analgesia group of multiparae, the control group of primiparae, the analgesia group of primiparae, slight asphyxia, moderate asphyxia and severe asphyxia. Among non-asphyctic infants, i.e. among infants in the combined analgesia and control group, we found a significant negative correlation between heart rate variability and duration of labour - infants born after a longer labour having a smaller variability. The heart rate variability is a very unspecific variable and it is important that the difference between control and analgesia groups should not be interpreted as a

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sign of increased risk to the child.

We also recorded the infant's respiration by transthoracic impedance plethysmography during the first two hours. The infants in the control group displayed a uniform pattern, with a decrease in the mean respiratory rate in the first hours of life. No such distinct pattern was seen in the analgesia group, where a decrease was seen in some infants in the same way as in the control group, but not in others. When we looked at the change in mean respiratory rate during the period 30 to 120 minutes after birth and related this change to the duration of stage 2 of labour, we found a significant correlation in the control material, a longer duration of stage 2 being associated with a greater change in the respiratory rate. But this correlation was not found in the analgesia group. In the preliminary analysis it was impossible to arrive at a common underlying explanation for these findings. No relationship between the concentration of lidocaine in the infant and the altered respiratory pattern was found. Eventually the common explanation for these observations became clear, but this will be discussed below.

When the blood sugar concentration of the control group and the asphyxia group were compared we found that the asphyxia group had significantly higher blood sugar values during the first hour than the controls. If we define hyperglycaemia as the mean value for the control group plus two standard deviations, then 64 % of the asphyxia group had hyperglycaemia. A significant negative correlation was observed between the blood sugar and the sum of the Apgar scores at 1, 5 and 15 minutes. Similarly, a highly significant positive correlation was demonstrated between blood sugar and lactate concentration and blood sugar and base deficit.

Regarding the analgesia groups, the blood glucose pattern was fairly similar amongst them, and during the first hour the mean values did not differ significantly from that of the control group. On the other hand the scatter was much greater in the analgesia groups than in the controls. In the analgesia group there was a significantly increased incidence of both hyper- and hypoglycaemia. When in the analgesia group we looked for other clinical signs of intrauterine stress than a low Apgar score, we found a distinct correlation between signs of intrauterine stress and hyperglycaemia. Eighty per cent of the cases with hyperglycaemia had either an abnormal foetal heart rate pattern, meconiumstained amniotic fluid or a maternal fall in blood pressure. Infants with signs of intrauterine asphyxia or distress thus tended to have a high blood sugar regardless of whether the mother had received nerve blockade during labour or not. The surprising finding, however, was the large incidence of hypoglycaemia in the combined analgesia group. About a quarter of the infants in this group had hypoglycaemia. Most of them were asymptomatic, and only one-fifthe had transient clinical signs compatible with hypoglycaemia. The pathophysiological background of the hypoglycaemia is inknown but there are probably several interacting factors.

One possible explanation is that glycogenolysis and/or glyconeogenesis in these infants are depressed after birth as a result of reduced influence of cortisol and/or catecholamines from the mother. It is known that both cortisol and catecholamines cross the placenta. The maternal level of these substances normally increases during labour, just as it is known that they increase during surgical procedures. It has also been shown that this cortisol increase does not take place either at operations or during labour under epidural blockade. It is therefore possible that a low blood sugar in the infant is due to a reduction of the maternal stress and pain through the nerve blockade.

Returning to what was mentioned earlier concerning the differences in respiratory rate in certain infants, in the further analysis it proved to be just those infants with hypoglycaemia who had a deviating change in respiratory rate.

Finally, regarding the results of the neurological and psychological investigations, all the details are not yet analysed, but I shall just mention briefly, that we found no differences between the control group and the analgesia groups at neurological examinations on the 1st and 4th days of life. As regards the psychomotor development at 18 months, our control group lay at a significantly higher level than the Swedish normal material but there was no difference between our controls and the analgesia groups.

In summary: we found no differences between the analgesia and control groups in the Apgar score, blood gases, acid-base status or lactate, nor in the neonatal neurology or psychomotor development at 18 months. On the other hand certain deviations in blood chemistry and some physiological variables were noted. These deviations in certain infants whose mothers had received nerve blockade during labour were most likely not caused by toxic effects of the anaesthetic drug but secondary to changes in the course of labour due to the nerve blockade. These effects have not been found to be associated with harmful longterm consequences to the infants of our study, but the findings illustrate how sensitive the foetus and the newborn infant are to altered environmental conditions. The observed effects must of course be confirmed by other investigations, and the mechanisms must be clarified in greater detail. Special attention should be paid to the increased incidence of hypo- and hyperglycaemia. The fact that we did not observe any deviations in the psychomotor development at 18 months' does not, of course, mean that teses might not be found in a material with a different composition from ours.

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