

CORD BLOOD SUGAR LEVELS AND THEIR VARIATIONS WITH MATERNAL INTRAVENOUS GLUCOSE INFUSIONS

by

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Before birth the foetus receives a continuous supply of glucose from its mother and its principal metabolic fuel is carbohydrates. The foetal blood sugar level at any time is the end result of placental transfer, glycogenolysis and neoglucogenesis in the foetal liver on the one hand and foetal tissue demands on the other.

The level of foetal blood glucose is relatively lower and fluctuates with that of the mother. The concentration of sugar in the umbilical vein has been shown to be somewhat less than the maternal blood sugar level.

Early work in different animals suggested that the foetal blood sugar rose towards that of the mother in late gestation; but when consideration is restricted to measurements of true glucose concentration (rather than total reducing substances) under good physiological conditions, it was found to be about half the maternal level throughout the latter half of gestation. Towards the end of gestation large stores of carbohydrate accumulate in the foetal tissues to tide over the transition period between birth and the establishment of efficient suckling. Immediately after birth there is a switch

over to fat which becomes the principal metabolic fuel of the neonate. There is thus a major change in the metabolism at birth.

The importance of the study of normal glucose levels has recently been realised because of our knowledge of this direct relationship of maternal blood glucose and also the fact that if these levels in the maternal blood are maintained, the foetus can overcome minor degrees of anoxia without showing obvious signs of distress.

In spite of the fact that glucose and fructose have the same molecular weight, Davies (1955) has shown that the latter passes much more slowly through the placental barrier. He also observed that the lower level of glucose in the foetal blood is probably maintained by placental metabolism.

Whaley *et al* (1966) observed that glucose transfer across the placenta follows a stereo-specific transfer mechanism. A very good correlation was found to exist between the levels of maternal and foetal glucose. Maternal concentrations were reflected very quickly by a similar change in the foetal circulation. There was, however, a steep slope of the regression line and a crossing of the ordinate below the original seemed to reflect the extreme dependence of the foetal level upon the maternal level. Maintenance of such glucose levels enhances the chances of foetal

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salvage, even in cases of moderate distress.

Material and Methods

A study of a total of 100 cases of normal delivery was carried out at the S. N. Medical College Agra.

An arbitrary grouping of the selected cases was done on the following lines:

Group I Control Cases

This group included 50 cases of normal confinement i.e. cases of vertex presentation in whom labour was normal and there was no evidence of foetal or maternal distress.

These cases received no glucose infusion.

Maternal venous sample was collected from the arm just prior to delivery.

Group II Study Group

A total of 50 cases of normal delivery (as qualified previously) were studied in this group.

These cases were given a 5 per cent glucose infusion during the second stage of labour.

A thorough general examination particularly for any evidence of oedema, pallor and hypertension was made as cases of pre-eclampsia, anaemia and any other associated maternal complication were excluded from the study.

A routine abdominal examination was made to assess the period of gestation, lie and presentation and the foetal heart rate was carefully counted.

An initial maternal venous sample was drawn in a 5 cc. syringe.

The progress of labour was watched. As soon as full effacement of the cervix with four finger dilatation was reached, a 5 per cent glucose infusion was started at the rate of 40 to 45 drops/minute. This

infusion was continued upto the time of delivery.

A second maternal venous sample was collected from the arm contralateral to the one in which the infusion was being given, just prior to delivery.

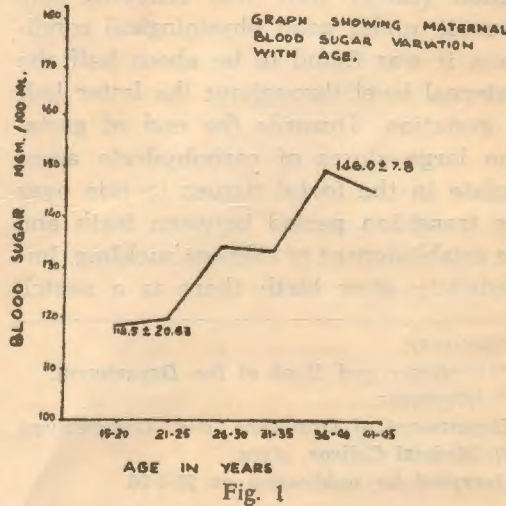
In both the groups with the delivery of the baby, a sample of the cord blood was drawn from the umbilical artery in a 5 cc. syringe. The blood samples were collected in oxalated tubes and submitted to blood sugar estimation by the Somogy—Nelson method.

Results

The cases studied were from the age of 18 years to 42 years. The maximum number of cases (14) fell in the 26 to 30 years age group.

The 36 to 40 years age group showed the highest values of maternal blood sugar (mean 146.0 ± 7.8 mg/100 cc.). On the other hand, the minimum range of values could be recorded in the 15 to 20 years age group, 96.0 to 162.0 mg/100 ml with the mean values of 118.5 ± 20.63 mg/100 ml.

With increasing age, it was observed that the maternal blood sugar showed a gradual but definite rise. (Graph I).



Morris *et al* (1964) found a mean maternal blood sugar of 80 mg/100 ml. Romney and Gabel (1966) recorded mean levels of 80.5 ± 6.33 mg/100 ml. Milner and Hales (1965) found levels of 97.0 ± 3 mg/100 ml while Paterson *et al* (1967) have found mean values of 102.0 ± 16.5 mg/100 ml.

In the non-infusion control cases, it is evident that there was practically very little variation in the mean blood sugar levels at the beginning of the second stage and the levels just prior to delivery, the former figure being 128.6 while the latter levels being 129.5 ± 16.5 mg/100 ml. It is therefore evident that the maternal blood sugar is maintained throughout the period of stress of the second stage of labour (Table 1).

The normal cord blood sugar levels varied from 65.0 mg/100 ml to 96.6 mg/100 ml. with a mean value of 74.1 ± 7.74 mg/100 ml. Maximum values were recorded in the 36 to 40 years maternal age group, while minimum levels were recorded in the 21 to 25 years age group 74.1 ± 7.74 mg/100 ml. (Graph 2).

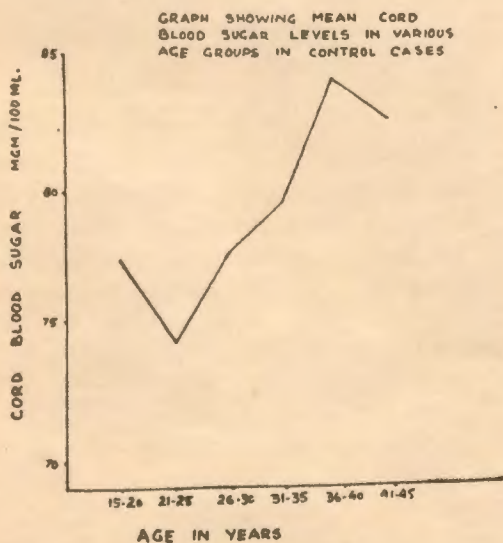


Fig. 2

Following an infusion of 5 per cent glucose during the second stage of labour, there was definite sustained rise in the maternal bloodsugar levels, which ranged from 149.9 mg/100 ml. to 198.0 mg/100 ml with a mean value of 171.8 ± 15.13 mg/100 ml.

The modes of administration of glucose have been varied by different workers.

Morris *et al* (1964) administered a continuous 40 per cent fructose infusion during labour giving a total of 160 gms. upto delivery. They have recorded initial maternal blood sugars of 80 mg/100 ml., which rose to 110 mg/100 ml., post infusion. The concurrent cord blood sugars were 53.3 mg/100 ml. and 78.5 mg/100 ml. respectively.

Romney and Gabel (1966) gave a loading dose of 25 gms. of glucose to their patients followed by a 20% continuous infusion and recorded post infusion levels of 220.2 mg/100 ml. in maternal blood and 185.4 mg/100 ml. in cord blood. Their initial levels were 80.5 mg/100 ml. and 71.05 mg/100 ml. respectively.

Paterson *et al* (1967) gave 100 gm. of dextrose infusion for over 2 hours to one group of patients and 50 gm. of dextrose within 5 minutes to another group. In the first group, the cord blood sugar rose from an initial level of 75.0 mg/100 ml., to 150 mg/100 ml. post infusion.

Comparing the maternal and cord blood sugar levels in group I cases, a materno-foetal gradient of 55.5 was observed, giving a 't' value of 5.4.

In group II cases, the materno-foetal gradient was 57.1 giving a 't' value of 3.7. All the values are statistically significant.

Summary and Conclusion

It may be concluded from our observations that there exists a definite corre-

lation between the maternal and foetal blood sugar levels. Following a 5 per cent glucose infusion, there is a rise in the maternal blood sugar levels and this is reflected in a concurrent rise in the cord blood sugar levels.

With the experience we have gained, it is obvious that it is possible to augment the foetal blood sugar values by giving a continuous 5 per cent glucose infusion to the mother during the second stage of labour.

References

1. Davies, J.: Am. J. Physiol., 181: 532, 1955.
2. Milner, R. D. J. and Hales, C. N.: Brit. Med. J., 5430: 284-286, 1965.
3. Morris, E. D., Wood, C. and Archer, G. D.: J. Obst. & Gynec. Brit. C'wth., 71: 766, 1964.
4. Paterson, P., Phillips, L. and Wood, C.: Am. J. Obst. & Gynec., 98: 938, 1967.
5. Romney, S. L. and Gabel, P. V.: Am. J. Obst. & Gynec., 96: 698, 1966.
6. Whaley, W. H., Zuspan, F. P. and Nelson, G. H.: Am. J. Obst. & Gynec., 92: 264, 1965.

